ST-5

Straight Line Tracking System

Technical Manual

WARNING

These technical instructions are for use by qualified service personnel only. To avoid electric shock, do not perform any servicing other than that contained in the operating instructions unless qualified to do so.

harman/kardon

SPECIFICATIONS:

Tracking Error:	0°
Skating Force:	0
Tone Arm Mass (effective):	6 grams
Stylus Overhang:	0
Rumble DIN B:	−57dB.
Wow and Flutter	
NAB Weighted:	0.045%
DIN B:	0.12%
Hum (Tone Arm In)	
DIN 45544:	−70dB.
Speeds:	33-1/3, 45 RPM
Motor/Drive:	Synchronous AC with precision ground belt
Platter Weight:	2.4 lbs/1.1 Kg
Dimensions (incl. dust cover):	6-3/4"H × 16-1/2"W × 16 1/4"D 171 mm. H × 419 mm. W × 413 mm. D
Weight Total:	20 lbs./9.1 Kg.

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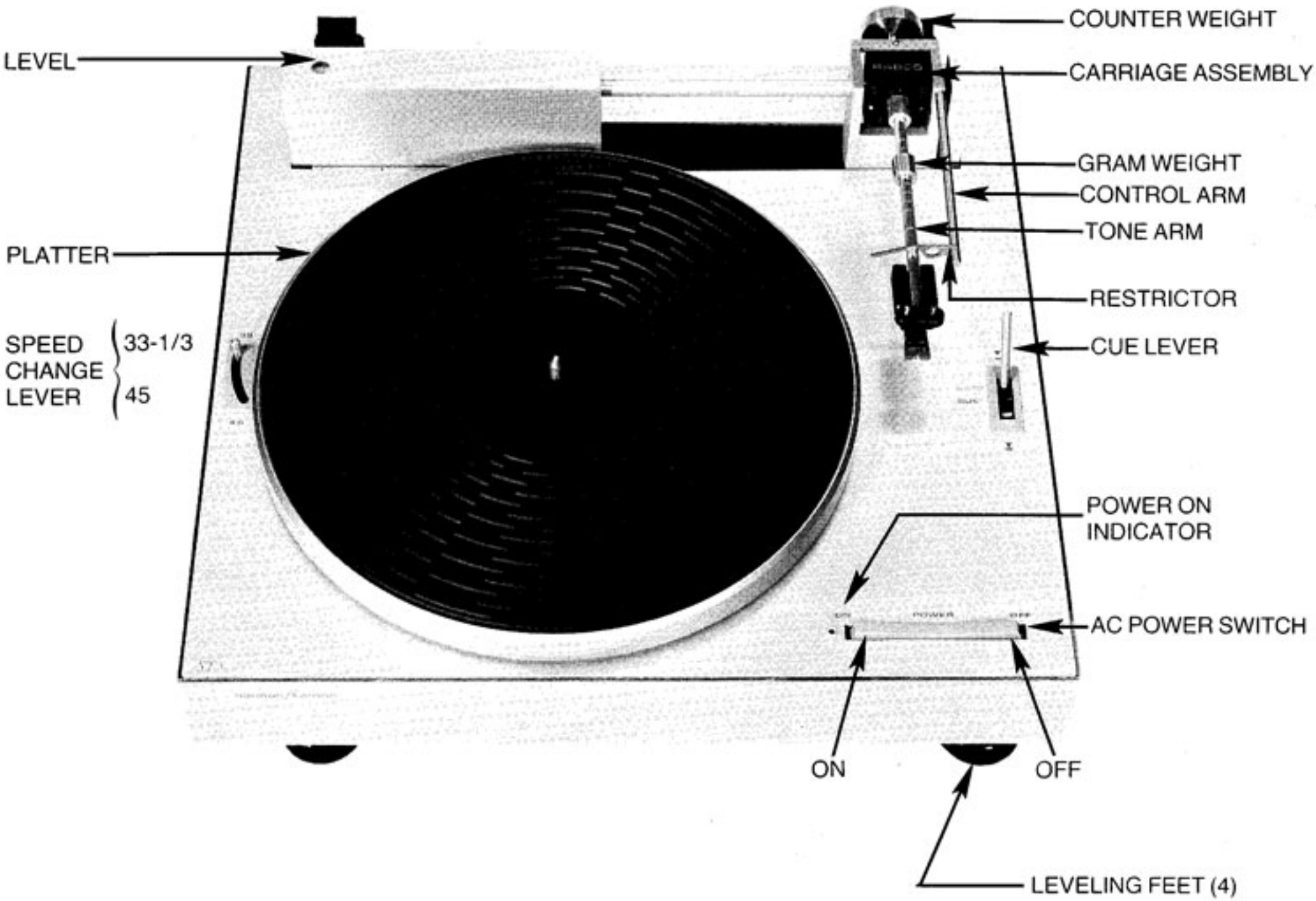


Warning: To prevent fire or shock hazard, do not expose this turntable to rain or moisture.

Figure 1. General View of ST5 Turntable

I MECHANICAL CONCEPT

The concept of the ST-5 mechanism is shown in Figure 2. The tone arm is supported in a two-axis gimbal mount. The horizontal axis contains the dashpot — damped stylus elevation mechanism. In the vertical axis the tone arm is supported by a tracking roller that rolls against the tracking shaft. When the tone arm is tangential to the record groove the tracking wheel is biased in angle so that the carriage travels toward the platter center at approximately 0.17 inch per minute. This corresponds to the average velocity of the master disc. As the tone arm attempts to pivot in angle to track pitch variations, the angle of the tracking roller axis changes relative to the cylinder axis. This change in direction of the tracking roller accelerates or decelerates the motion of the carriage to track the pitch of the groove. The correction is continuous, self-adjusting, and automatic.

FIGURE 2. TRACKING AND DRIVE SCHEMATIC

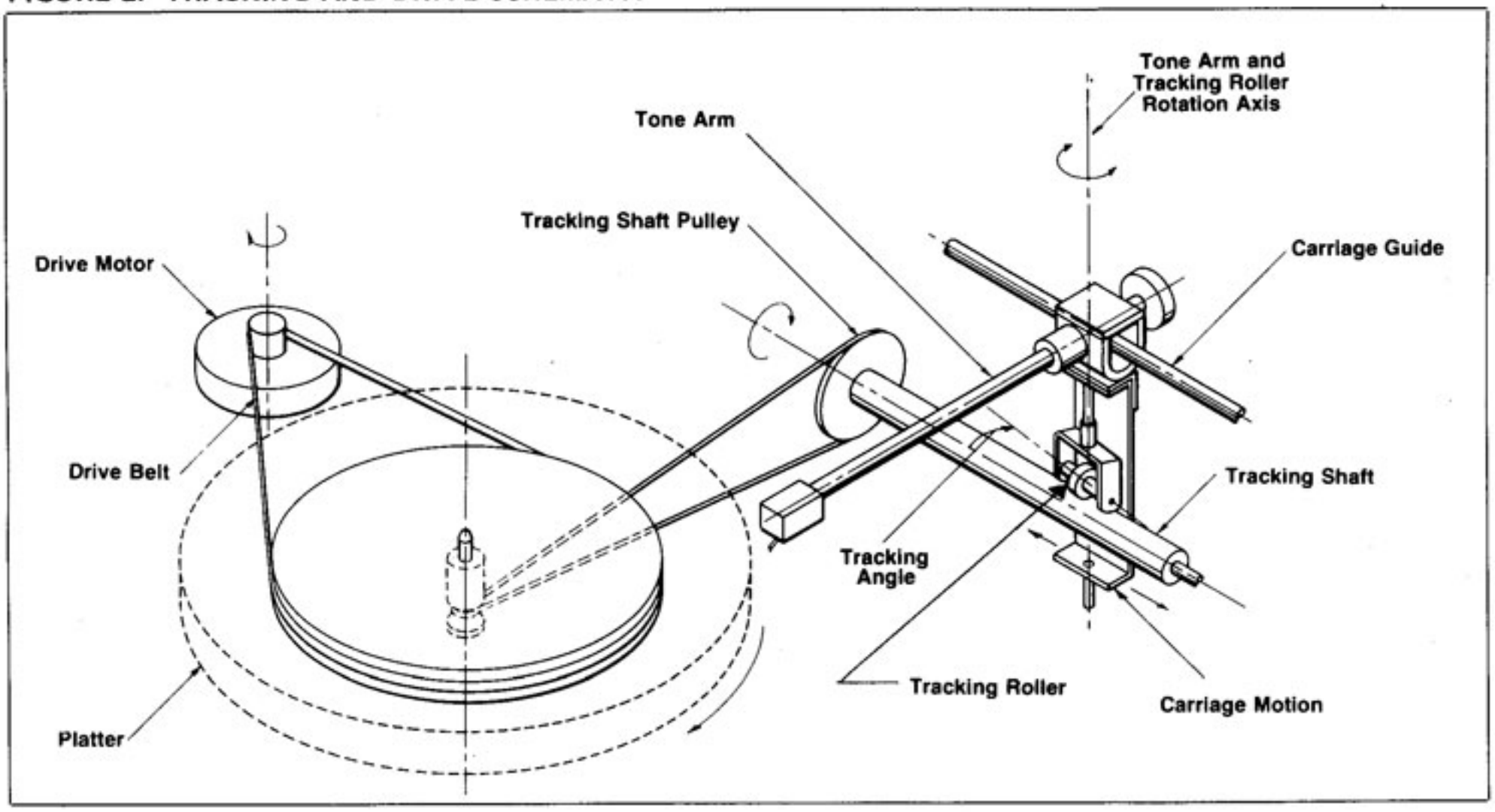


Figure 2. Tracking and Drive Schematic

II TROUBLESHOOTING

(Refer to Figures 3, 10, and 11)

Conditions	Possible Cause & Corrective Measures
1. When the arm is cued to the "up" position, the arm does not nestle all the way up into the notch of the restrictor arm.	1. a. Stop bar screw not properly adjusted or loose. Refer to stop bar screw adjustment procedure. b. Gap between threaded lift pin and lift bracket too large. Refer to threaded lift pin adjustment. c. Incorrect position of dashpot stud. Refer to dashpot adjustment.
2. With the arm "up" the carriage assembly does not move freely enough from left to right.	2. a. Insufficient gap between threaded lift pin and lift bracket. Refer to threaded lift pin adjustment. b. Dirt build up under slide tube bushings. Clean slide rod and bushing area with alcohol. c. Stop bar set screw too tight. Refer to stop bar set screw.
3. When the arm is cued "down", the stylus does not reach the surface of the record.	3. a. Cartridge not shimmed properly. See owners manual. b. Stop bar screw adjusted too far down preventing the roller assembly and tone arm from dropping to the correct position. Refer to stop bar screw adjustment. c. Foreign object jammed under lift bracket.
4. When the arm is cued "down", an initial fast drop occurs before the damping action takes place.	4. a. Too large a space between the tip of the dashpot plunger and the lift bracket surface. Refer to dashpot adjustment. b. Threaded lift pin adjusted for too much air gap between the lift pin and the lift bracket. Refer to threaded lift pin adjustment. c. Stop bar set screw set incorrectly. Refer to stop bar set screw adjustment.
5. When the arm is cued "down", no damping takes place at all. Arm drops hard and quickly to the record surface.	5. a. Defective dashpot. Replace dashpot. b. Dashpot set all the way up to the full height of the mounting stud. Refer to dashpot adjustment.
6. Extreme drift of tone arm as it comes down on the record.	6. a. ST5 not on a level surface. b. Tone arm improperly balanced or weighted. c. Stop bar screw not engaged in roller guide groove. Refer to stop bar adjustment. d. Slide tube flat surface not correctly positioned inside roller assembly. Remove top cap of roller assembly and observe that flat portion of the slide tube is vertical facing the front of the unit. To reposition, remove the 2 rear screws holding the stop bar; loosen the set screw, and rotate the slide tube to the proper position. Retighten the set screw. Reassemble and readjust the stop bar.
7. As arm tracks across record, arm starts to "lead" the carriage.	7. a. Mis-adjustment of tracking screw. Turn screw clockwise in very small increments until proper tracking occurs. Recheck for proper tracking. b. Foreign object jammed under lift bracket. c. Threaded lift pin adjusted with no air gap between the lift pin and the lift bracket. See threaded lift pin adjustment. d. Extension spring ( ) off. e. Slide shaft belt off pulley. f. Slide shaft and/or tracking shaft extremely dirty. Clean with alcohol.

II TROUBLESHOOTING (continued)

Conditions	Possible Cause & Corrective Measures
8. As arm tracks across record, arm starts to "lag" behind carrriage.	8. a. Mis-adjustment of tracking screw. Turn screw counter-clockwise in very small increments until proper tracking occurs. Recheck for proper tracking. b. Tracking roller Spring (113) broken or one end disconnected.
9. Arm lifts and unit returns to "stop" mode before record material has been completely played.	9. a. Check tracking—if arm is "leading" the carriage, reset tracking as per step 7a.
10. Arm gets to end of record but does not switch to "stop" mode.	10. a. Check tracking—if arm is "lagging" the carriage; reset tracking as per step 8. b. Refer to tripping adjustment.
11. Arm gets to end of record and lifts up but the unit does not switch to "stop" mode.	11. a. Micro-switch S3 incorrectly positioned. Refer to micro-switch adjustment. b. Micro-switch defective; replace micro-switch. c. On/off switch S1 stuck in on position.
12. Arm gets to end of record and lifts off record but does not return all the way up into the notch in the restrictor arm.	12. a. Insufficient tension for the tone arm caused by too large a gap between the threaded lift pin and the lift bracket. Refer to threaded lift pin adjustment. b. Restrictor arm incorrectly positioned. Refer to restrictor arm adjustment. c. Stop bar set screw too loose. Refer to stop bar set screw adjustment. d. Burrs on restrictor, tone arm or stop bar screw tip. Remove with croquis cloth (very fine).
13. Unit tracks poorly and jams tripping gears—particularly after being disassembled for service.	13. "O" ring installed with reversed twist. Install "O" ring so that as the spindle and bearing assembly is turned clockwise, the tracking shaft rotates clockwise as viewed from the tracking gear end.
14. Scraping noise heard when platter is running. (After shifting and running at correct speed.)	14. a. Pulley not properly positioned. Refer to Belt Shifting Adjustments. b. Turntable belt twisted. Carefully remove the belt and reinstall properly with the shiny side of the belt in. c. Motor not properly positioned. Refer to motor alignment.
15. Excessive "Wow and Flutter."	15. a. Turntable belt twisted, worn or with rough spots. Replace or reposition belt. b. Motor binding. Replace motor. c. Tracking shaft binding. Loosen tracking shaft pulley wheel and reposition for more end play. d. Defective "O" ring. Replace. e. Turntable bearing contaminated. Clean and relubricate. f. Nick on tracking shaft pulley. Polish with very fine emery paper.
16. Excessive "rumble."	16. a. Motor mounts loose, tighten. b. Defective motor. Replace.
17. Arm intermittently does not return to notch in restrictor arm. Also binding of carriage left to right.	17. Slide tube flat area not properly positioned. Refer to step 6d.
18. Loss of L or R channel.	18. a. Defective cartridge. b. Open (broken) or shorted wires between receptacle on roller assembly and output cables. Check continuity of all 4 wire paths.

II TROUBLESHOOTING (continued)

Conditions	Possible Cause & Corrective Measures
19. Hum (electrical)	19. Broken circuit in ground path. Scrape through anodize on underside of cartridge holder, and check continuity between receptacle shell and chassis. (See note in owners manual on cartridge.)
20. Hum pick up as hand goes near arm. Static audible as carriage is moved manually from left to right.	20. Loose knurled nut on tone arm. Tighten by hand as securely as possible.
21. Unit does not light up.	21. a. Blown fuse. b. Check that AC switch is "on". c. Faulty pilot light assembly; replace.
22. Unit starts but shuts off immediately.	22. a. Rotate platter counterclockwise one revolution and try to start. Trip pin may have become engaged due to shipping. b. Trip pin positioned incorrectly. Refer to micro-switch position adjustment.
23. Platter wobble.	23. a. Check for missing bowed washer and retainer. b. Check for defective post and hub assembly.
24. Cueing lever works but arm won't drop.	24. a. Improperly balanced and weighted tone arm. b. Extension spring (110) off.
25. Acoustic feedback.	25. a. Check all four feet; four are equally soft and not deformed. b. Check unit is level. c. Check for close proximity of speaker. d. Adjustable foot contacting hardware on base. Turn out to a higher position.
26. Chattering or scraping as carriage is moved with arm up.	26. a. Dirt on lift plate; clean. b. Burr on slide shaft. Remove with croquis cloth (very fine).
27. Unit will not cue up and shut off with certain records.	27. Excessive or insufficient lead out groove area; leadout beyond RIAA standards.
28. High frequency content of program material sounds excessively brilliant.	28. Cable capacitance needs to be matched more closely to cartridge. Refer to cable capacitance matching in adjustment section. ST5 cable capacitance is approximately 110 pf. (including tone arm).
29. Hum (mechanical)	29. a. Motor plate contacting shifter plate due to a bent condition. b. Motor plate loose. c. Motor isolators or standoffs loose.
30. Speed incorrect (as checked with a strobe.)	30. a. Belt not riding on crown of pulley. Refer to motor alignment. b. Belt worn. Replace. c. Insure correct pulley for line frequency. Small version 60HZ, large version 50HZ. d. Belt stuck between 33 and 45 drive shoulders on pulley. Refer to belt shifting adjustments.
31. Ticking noise when platter is rotating.	31. Trip gear rubbing on tracking gear. Refer to microswitch adjustment.

III DISASSEMBLY PROCEDURE

To service various portions of the ST5, it may be necessary to partially or fully disassemble the unit. For purposes of explanation, we will identify these as four stages of disassembly. For each adjustment, we will specify which stage or stages of disassembly are required to accomplish the repairs or adjustments.

STAGE 1 – REMOVAL OF PLATTER AND MAIN DRIVE BELT

STAGE 2 – REMOVAL OF TOP PLATE, FRONT

STAGE 3 – REMOVAL OF LEFT HAND COVER AND TOP PANEL, REAR

STAGE 4 – REMOVAL OF SIDE WALL

A WORD OF CAUTION ... The items described are ALL dress pieces and have been finished to provide a high quality aesthetic appearance.

EXTREME CARE should be taken when removing, storing, or replacing these parts to avoid scratching or damaging their appearance.

STAGE 1 – Remove mat, retaining ring and curved washer. Remove platter and main drive belt.

STAGE 2 – Remove entire tone arm assembly from carriage, remove two screws holding top front panel in place, remove top front panel.

STAGE 3 – Remove two screws and then left hand cover, remove two panel screws and then rear top panel.

NOTE: Use caution in removing plate. Be sure it does not become scratched by the tracking adjustment screw.

STAGE 4 – Remove six screws and lock washers from the bottom and then the entire side wall as an assembly.

LIST OF TOOLS REQUIRED

The tools normally found in a well-equipped service shop generally will suffice in the disassembly and servicing of the ST-5. However, the following lists standard tools required that can be considered semi-special.

1. 1/4 Socket or Nut Driver (Hollow)
2. 3/16 Socket or Nut Driver (Hollow)
3. 5/16 Socket or Nut Driver (Hollow)
4. 3/16 Open End Wrench (Small pattern)
5. 1/4 Open End Wrench (Small pattern)
6. .050 Hex Key Wrench (Allen)
7. 1/16 Hex Key Wrench (Allen)
8. Pliers, Ext. Ring (Waldes 0018 or equiv.)
9. 1/2 Socket or Nut Driver (Hollow)

IV ADJUSTMENTS

Figure 3 shows the ST5 after all four stages of disassembly. The callouts represent location of adjustments that will be referred to in the following paragraphs. It is recommended that you familiarize yourself with the location of these adjustments.

For some adjustments supplementary line drawings are included with the actual procedure, to provide greater clarity.

Adjustments included are:

1. Threaded Lift Pin
2. Dashpot
3. Tripping
4. Stop Bar Screw
5. Stop Bar Assembly Adjustment
6. Microswitch Position
7. Restrictor Arm
8. Speed Shift and Motor Alignment
9. Conversion of ST5 Multivoltage Units
10. Cable Capacitance Matching
11. Carriage Assembly Removal
12. Tracking Screw Adjustment

LUBRICATION

All necessary pivot and bearing surfaces have been lubricated at the factory and will seldom, if ever, require further attention.

Refer to figure Exploded View for positions.

Motor (Item 119)	The motor is a slow RPM (300) AC Syncronous type that has pre-lubricated bearings. It should require no further lubrication for the life of the unit under normal operating conditions.
Platter Bearing (Items 16 & 17)	The platter turns on a brass bearing and hardened stainless steel post, both of which are lubricated with a special TFE filled synthetic oil. Under normal operating conditions, it is not necessary to replace this oil for at least 3,000 running hours. When replacing, we recommend you use the same lubricant.
Linkages (Items 11 & 73)	To be greased sparingly, when required, with a medium consistancy silicone grease or equivalent.

Exercise care to keep the motor pulley (90, 91), belt (103, 218), platter drive ring (36), tracking shaft (72), trip pin (70), tracking belt (104), tracking pulley (50), and bearing tracking groove (17), free of oil or grease. If necessary these can be cleaned with alcohol.

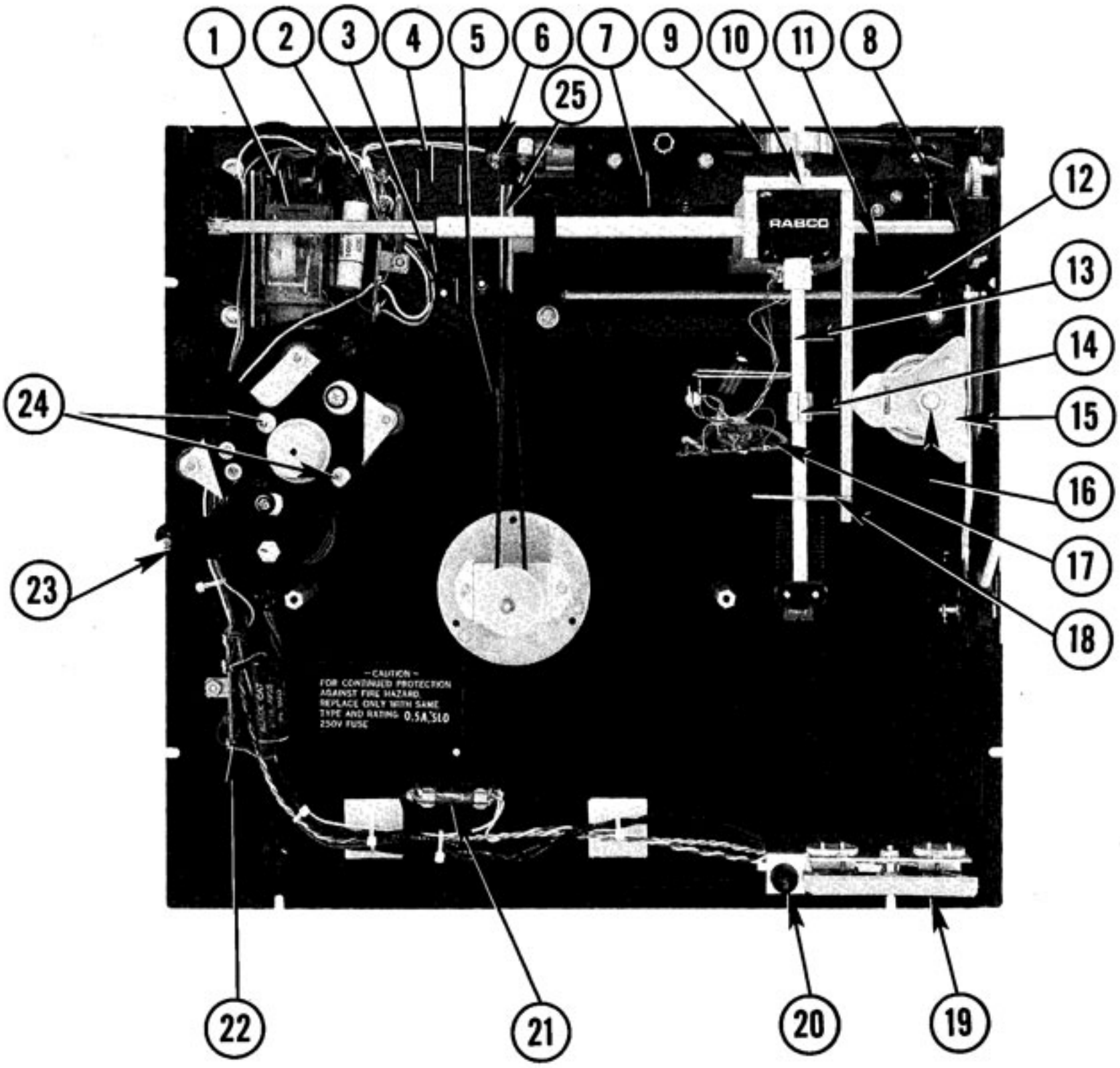


Figure 3.

1	Relay
2	Terminal Board TB3
3	Multivoltage Switch (Export only)
4	Terminal Board TB4 (Export only)
5	Tracking Belt
6	Trip Spring Assembly
7	Trip Actuator
8	Slide Shaft Belt
9	Counterweight
10	Stop Bar Set Screw
11	Tracking Shaft
12	Lift Plate
13	Tone Arm
14	Gram Weight
15	Dashpot
16	Dashpot Locknut
17	Terminal Board TB1
18	Restrictor
19	Power Switch
20	Pilot Light
21	Fuse
22	Terminal Board TB2
23	Belt Shifter
24	Motor Alignment Screws
25	Tracking Shaft Pulley

1. THREADED LIFT PIN ADJUSTMENT

A. Reason

To allow for a clearance between the lift pin and the lift plate surface in the arm "down" position so that tracking will occur as a function of the tracking roller and the tracking wheel contacting each other properly. (Refer to Figure 4.)

B. Pre-Condition

None

C. Required Disassembly

Stages 1 through 4

D. Method of Adjustment (Use Tool No. 4)

With the arm "down" on the surface of a record, adjust the threaded lift pin with a small 3/16" open end wrench to produce a very slight air gap between the head of the lift pin and the surface of the lift plate. This gap should be approximately .020 inches.

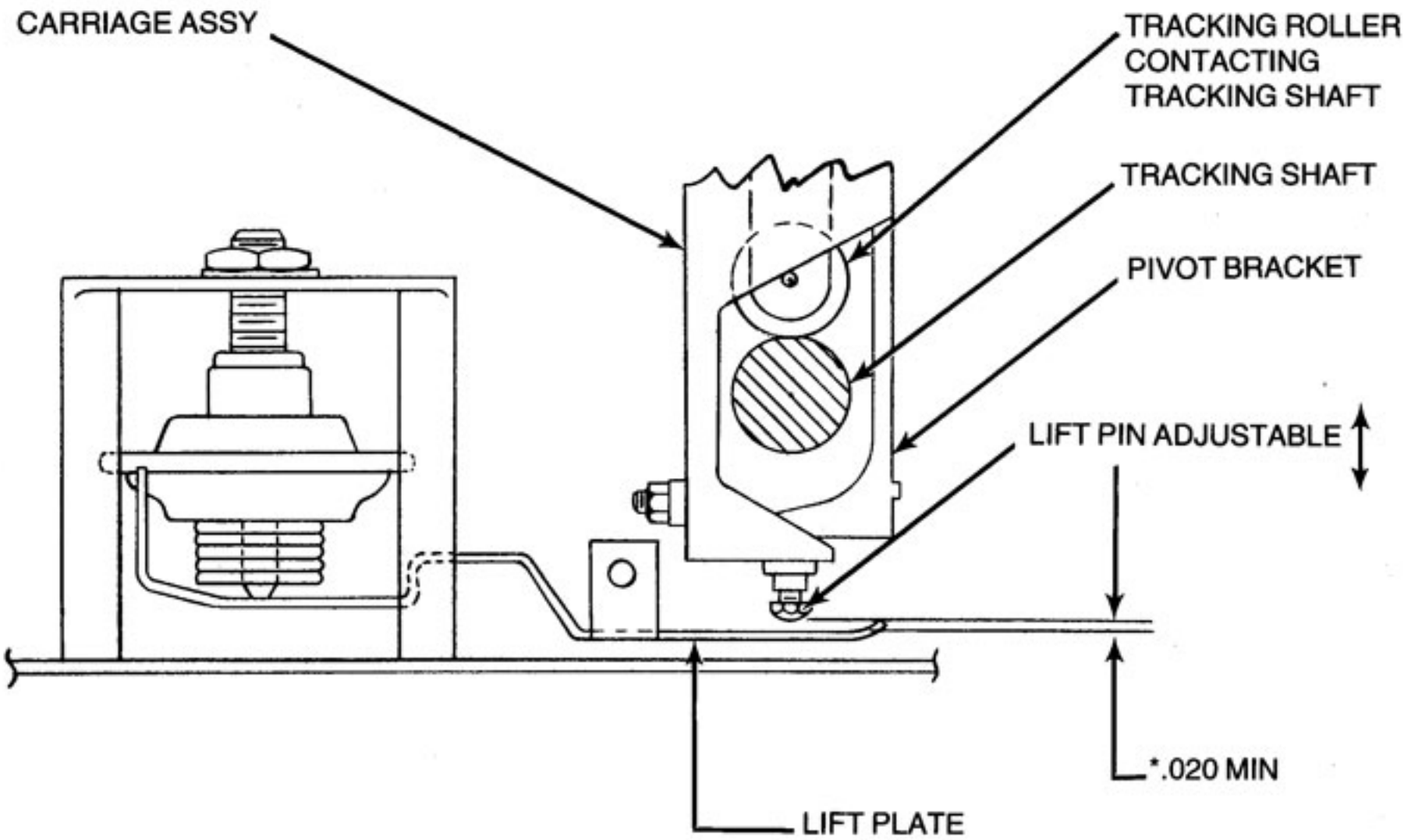
After adjustment, the arm, when cued "up", must cradle properly into the restrictor arm notch and the carriage should move freely from left to right in the arm "up" position. Refer to Stop bar screw adjustment.

SPECIAL NOTE:

The gap between the lift plate and the lift pin while typically .020 can vary from unit to unit. The gap can be made smaller or larger if necessary to achieve the following:

1. Free lateral movement of carriage in the arm "up" position.
2. Arm must remain cradled in the restrictor notch as the carriage is moved left to right with the arm "up."
3. A gap is visible between the lift pin and lift plate at the extreme ends of the left and right carriage position with the arm in the "down" position.

*GAP MUST BE MAINTAINED
FOR COMPLETE CARRIAGE TRAVEL



A. Cued Down Position

Figure 4a. Dash Pot and Threaded Lift Pin Adjustments

2. DASH POT ADJUSTMENT

A. Reason

To permit the arm to lower itself slowly to the record surface when the cue lever is moved downward rapidly. (Refer to Figure 4.)

B. Pre-Condition

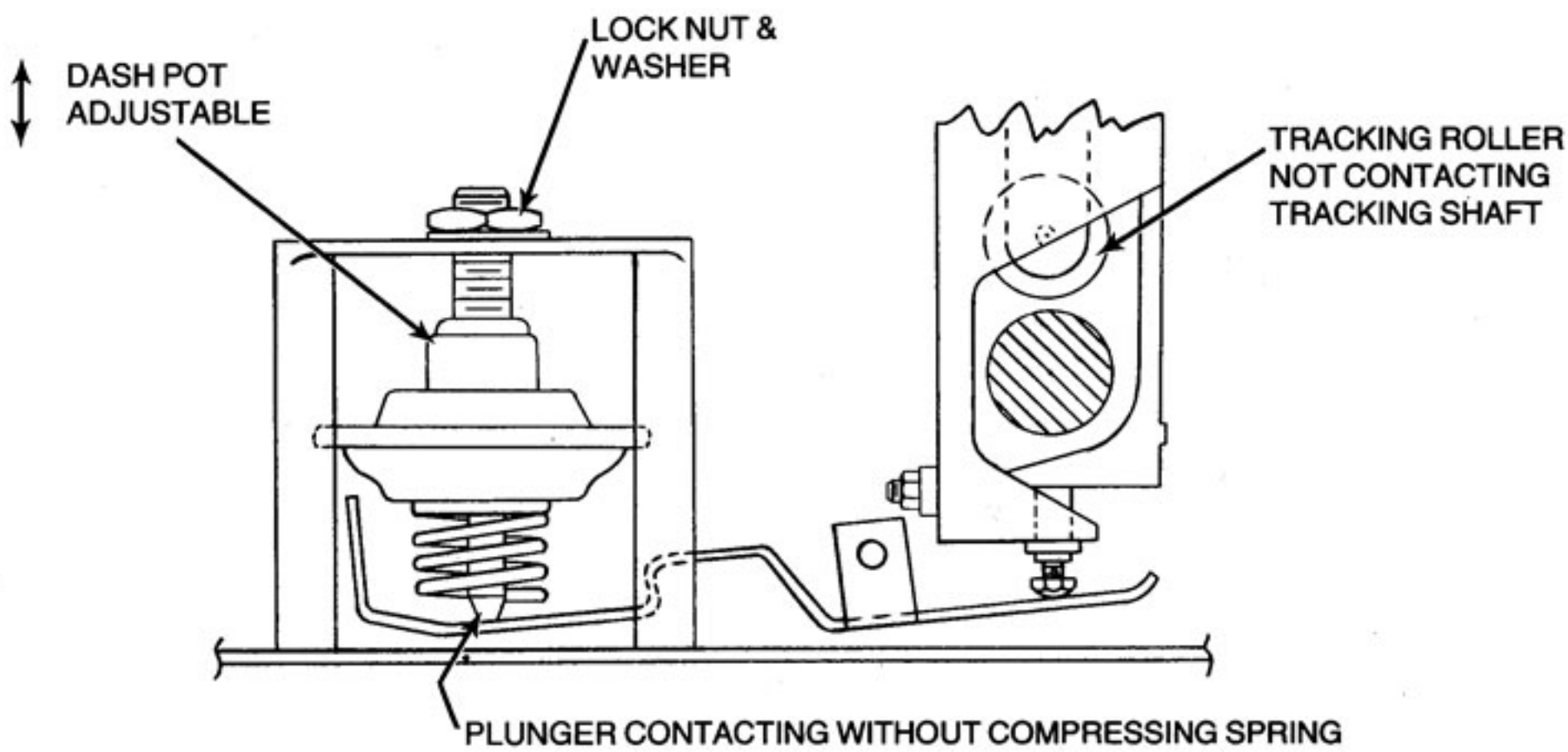
The stop bar screw and lift pin adjustments must be set.

C. Required Disassembly

Stage 1 and 2.

D. Method of Adjustment (Use Tool No. 9.)

With the arm cued to the "up" position, loosen the locking nut on the dash pot stud. Turn the entire dash pot counter-clockwise until there is a large gap between the dash pot plunger and the top surface of the lift plate. Then adjust the dash pot clockwise until the plunger is snug against the lift plate surface. (Refer to Figure 4.) Hold the body of the dash pot and secure the locking nut to hold in place.



B. Cued Up Position

Figure 4b. Dash Pot and Threaded Lift Pin Adjustments

3. STOP BAR SCREW ADJUSTMENT

A. Reason

To allow the arm to cue far enough down so the tracking force weighting applies and allows the arm to track.

B. Pre-Conditions

1. Cartridge must be shimmed (if required).
2. Tone arm/cartridge must be zero balanced and have correct tracking gram force set. (See Owner's Manual for the above.)
3. The lift pin and stop bar assembly adjustments must be set.

C. Required Disassembly

None

D. Method of Adjustment (Refer to figures 3 and 5) (Use tool No. 6)

1. With cue lever in the cue down position, adjust the screw to permit the lower surface of the cartridge (near stylus) to reach the top surface of the platter (without record or mat). This position should suffice in most cases; but to satisfy other conditions, it can vary slightly. See threaded lift pin adjustment.
2. Check that when the arm is cued down on a record, there is a visible gap between adjusting screw tip and the cue guide.
3. Check that the tone arm, when cued up, is just contacting the restrictor at various carriage positions.

CAUTION: 1. THE STOP BAR SCREW/ROLLER GAP BEING OVER ADJUSTED IN THE DECREASING DIRECTION CAN PREVENT TRACKING, PARTICULARLY IF THE CARTRIDGE IS NOT SHIMMED (IF REQUIRED) OR THE RECORD (USED IN THIS ADJUSTMENT) IS EXTREMELY WARPED.

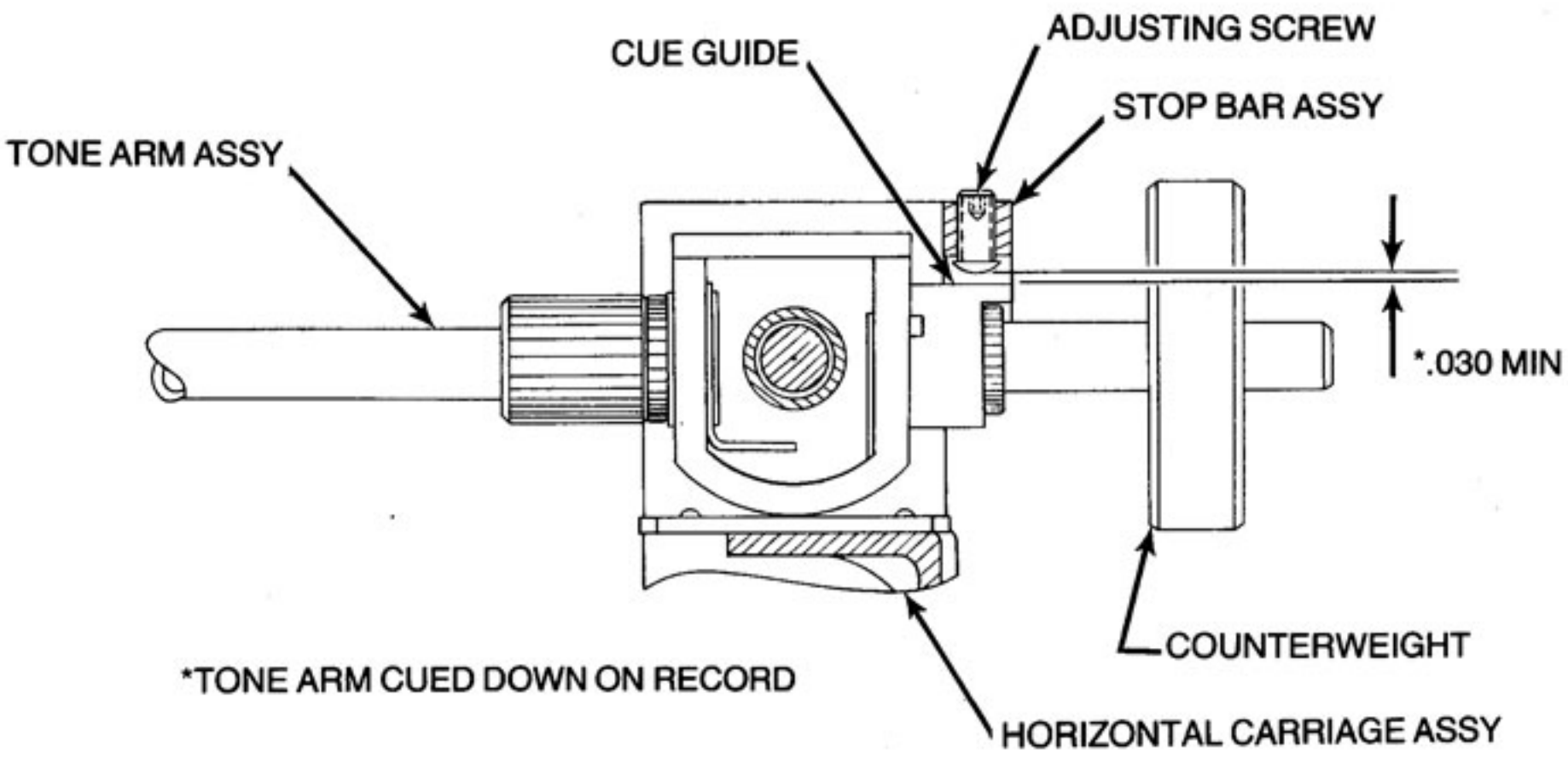


Figure 5. Stop Bar Screw Adjustment

4. TRIPPING ADJUSTMENTS

A. Reason

To ensure that trip function (automatic tone arm lift off) operates properly at end of a record.

B. Pre-Condition

The tracking, stop bar and end of travel microswitch adjustments must be complete.

C. Required Disassembly

Stage 3

D. Methods of Adjustment

When replacing parts of sub-assembly:

1. Check that trip plate assembly swings freely by itself when mounted on a level surface. If not, adjust pivot screw, by loosening jam nut, out clockwise in *very* small increments. Lock jam nut.

   CAUTION: Axial end play on pivot should be minimal. Exercise care not to deform any parts as they are extremely delicate.

2. Adjust stop bracket by deforming tab against stop screw for a nominal 3/64" gap between the kick foot and the trip pin. The trip pin should be in its maximum back position and the trip gear detented. Check by manually pushing trip pin in to engage the tracking gear; rotate (manually) the tracking shaft by rotating the platter clockwise to cause the trip gear to cycle. During the rotating cycle of the gear, the opposite end of the trip pin should just clear the kick plate by 1/64" or less. When the gear stops in its detented position, the resulting gap between the trip pin and kick foot will be correct (approximately 3/64").

3. Adjust spring, by turning screw so that when the carriage is in the extreme left hand position and the tone arm is cued down, the actuator just contacts or just clears the trip spring without bending it.

   Note: a) If there is not enough adjustment range in the adjustment screw, back it out to a mid-range position and bend the spring holder tab as a rough adjustment and fine adjust per above.

   b) Check that when the tone arm is cued *up*, and the carriage is moved laterally, the actuator doesn't contact the trip spring.

4. Move the carriage and cue the tone arm down so that the actuator is approximately 1/4" away from the trip spring and allow it to track at 33-1/3. Observe that the actuator stays in front of the trip spring and does not enter the loop of the spring. Adjust as required per Paragraph 3. In some cases the tracking can be adjusted *slightly:* turning the tracking adjustment clockwise will increase the trip spring-actuator gap; turning it counter-clockwise will decrease the gap.

5. Checking Tripping: With the tracking force set at .75 gms minimum on:

   a) A commercial record with small run out margin (approximately 3/8" wide).

   b) A commercial record with large run out margin (approximately 1" wide).

   c) A commercial record with large interband crossover (approximately 1/16" wide) located close to the end of recording.

   NOTE: A clean record and stylus in good condition must be used. When checking tripping, the stylus should be set down in the preceding band a short distance to allow the tracking to normalize.

   The unit should trip on test a and b, but not on test c.

   a) If no tripping on test a, readjust items 2 and 3 for slightly lesser gaps.

   b) If no tripping on test b, check tracking force, a restriction of the trip plate assembly or item 4.

   c) If tripping occurs on test c, readjust items 2 and 3 for slightly greater gaps. Assure that tone arm is not leading.

   NOTE: In some cases records are made that do not conform to industry standards. They will either have run-out margins that are too large or small. If the margin is excessively large, the actuator will completely miss the trip spring. In this case no tripping is normal. In the case of excessively small margins, the amount of motion may be insufficient to actuate the trip plate. This is also normal.

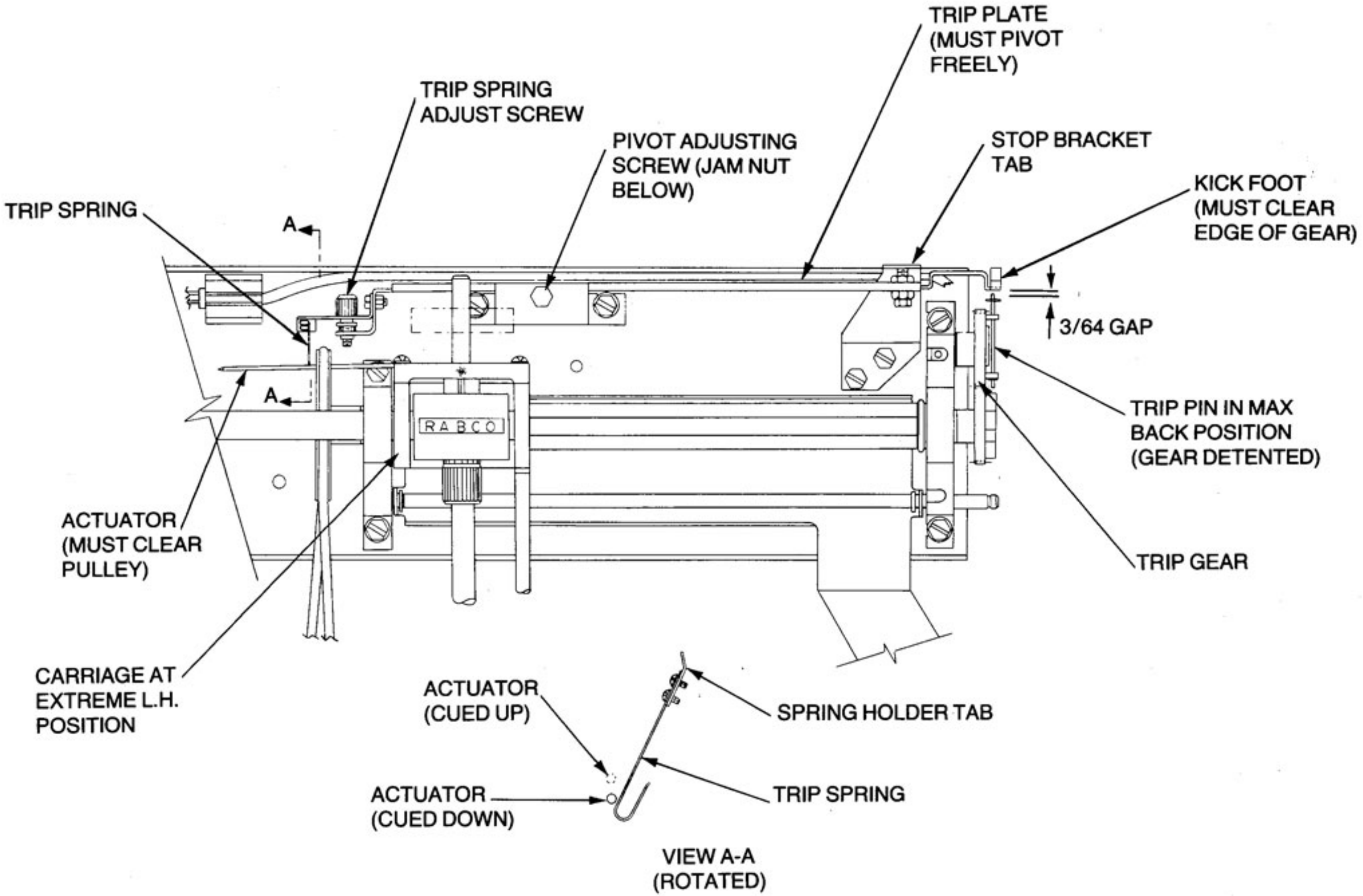


Figure 6. Tripping Adjustments

5. STOP BAR ASSY. ADJUSTMENT

A. Reason

To assure that the tone arm, roller assembly is aligned correctly and cues down straight.

B. Pre-Conditions

1. Tone arm/cartridge must be properly balanced and weighted.
2. The cartridge must be shimmed (if required).
3. The lift pin adjustment must be set.

C. Required Disassembly

None

D. Method of Adjustment

1. With the cue lever in the cue up position, loosen (2) mounting screws, but leave them hand tight. Adjust the stop bar assy, side to side, so that the tone arm tube is centered in the flat notch in restrictor. The spherical tip of the adjusting screw must be in the "V" groove.
2. Cue tone arm down on record and check for straightness of drop. Arm must return to center of flat when cued up. Tighten (2) mounting screws.
3. There must be a visible gap between spherical tip of screw and roller guide when cued down on a record. See stop bar screw adjustment.

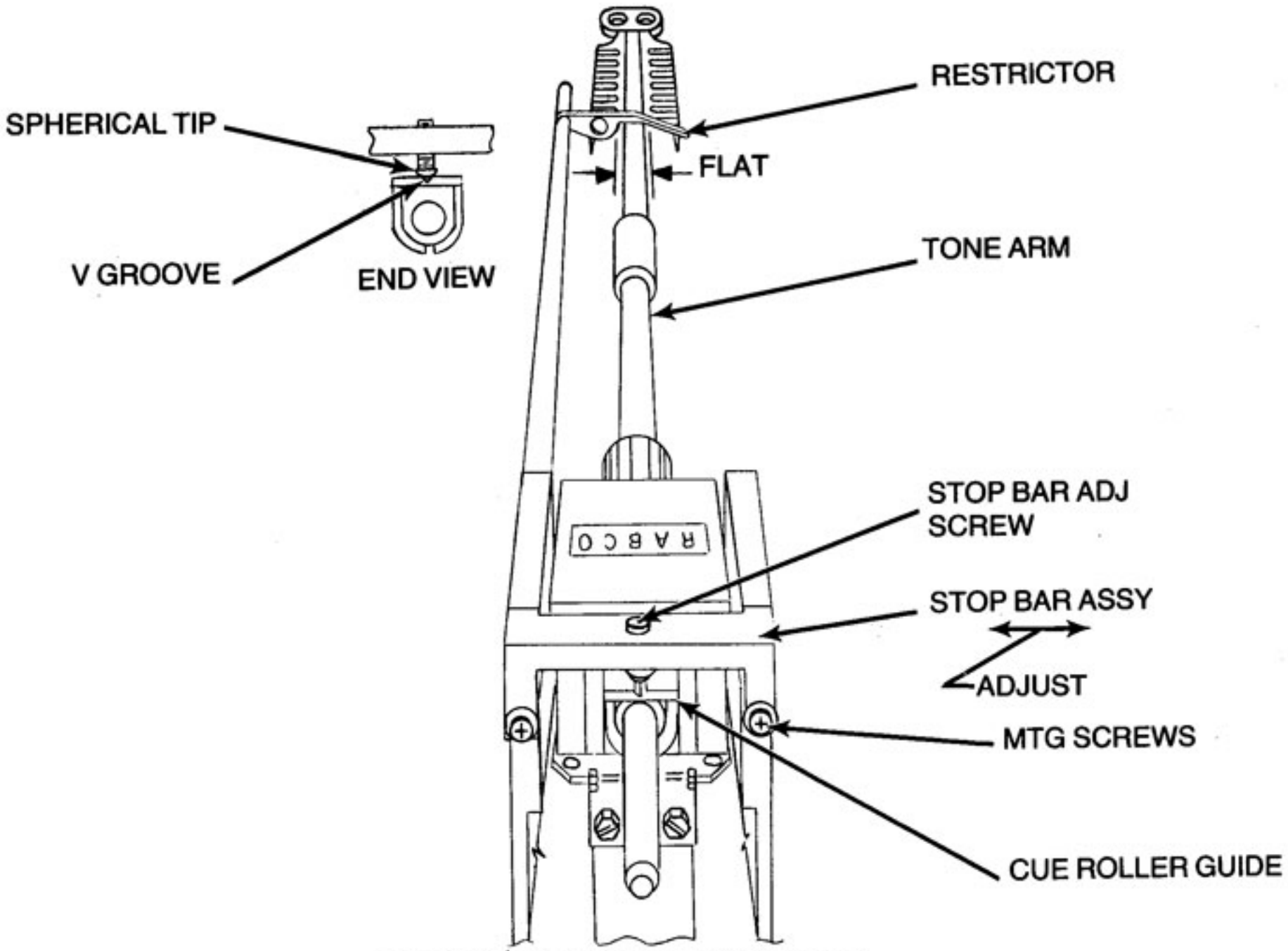


Figure 7. Stop Bar Assy Adjustment (Counterweight Removed for Clarity)

6. MICROSWITCH POSITION ADJUST

A. Reason

To position the trip gear/pin assembly in the detent mode and locate the microswitch for end of cycle shutoff.

B. Pre-Condition

None

C. Required Disassembly

Stages 1 through 4. Remove retaining ring (155), washer (207) securing linkage (11) to trip gear assembly. Move linkage down for access.

D. Method of Adjustment (Refer to figure 8)

1. Adjust the microswitch side to side so that when the roller on the lever is engaged in the detent (indentation) of the trip gear, the trip pin is horizontal to slightly off horizontal in a clockwise direction. The teeth on the tracking gear should not rub the trip gear teeth. Tighten the two screws, loosely.
2. Position the microswitch vertically so that the roller doesn't jam on the cam when the trip gear is rotated CCW out of the detent position. Check by rotating the trip gear CCW until the cam portion actuates the switch and a "click" is heard. Continue rotating CCW until back in the detent position and another "click" is heard. Tighten the two screws.

   CAUTION: THE TRIP PIN MUST BE KEPT FREE OF GREASE AND DEBRIS. IT MUST ALSO BE ABLE TO MOVE FREELY BY ITSELF WHEN THE TRIP GEAR IS ROTATED.

3. Check operation electrically:
   With full size platter installed run at 33⅓ RPM. Push trip pin in manually with the tone arm cued down. After the trip cycle is activated the following should occur; the tone arm lifts up, the motor and pilot light shut off, and the relay "clicks" followed by the microswitch "click". Try starting again by momentarily depressing the on switch, if the switch has to be held, the microswitch tension is too tight against the trip gear detent.

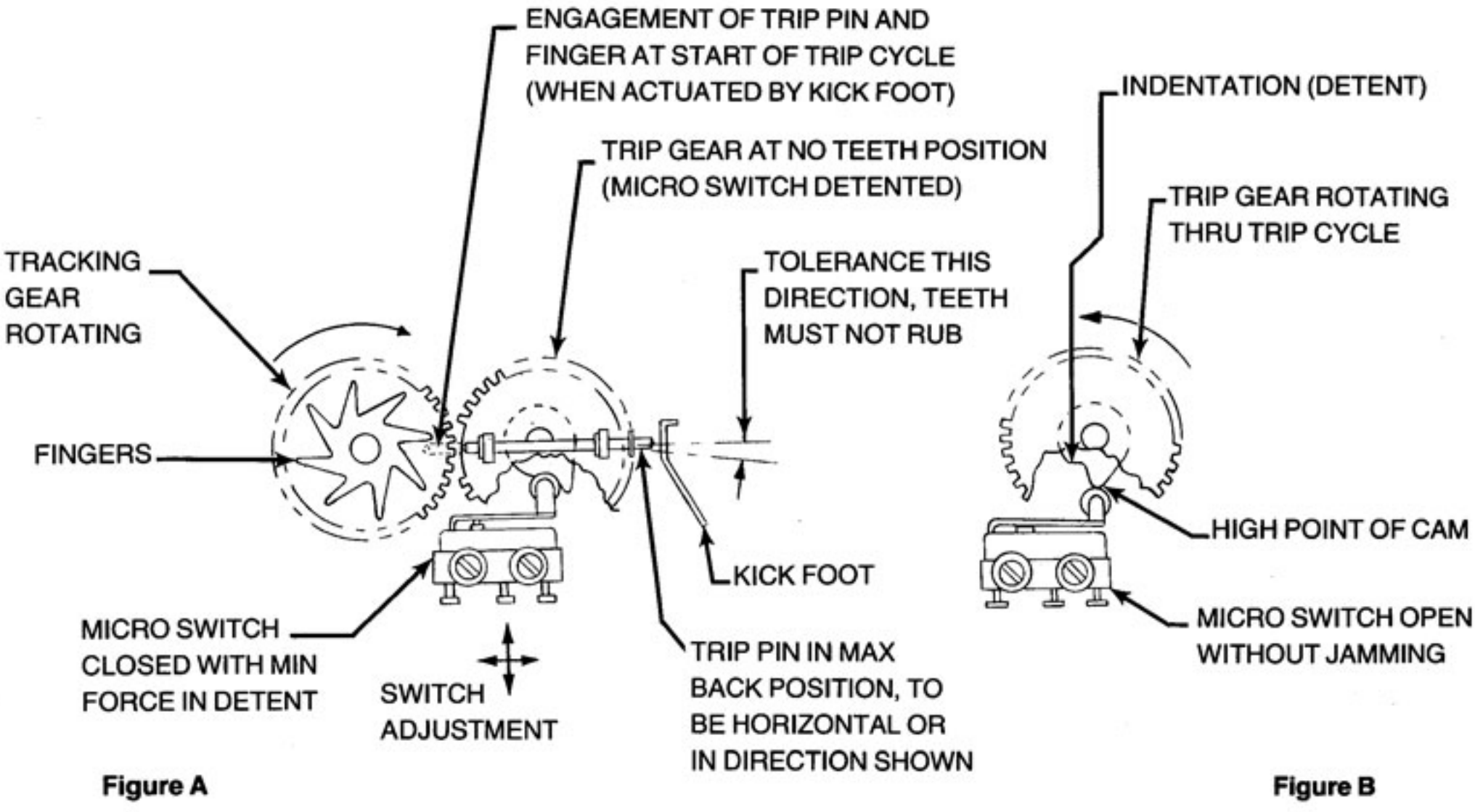

ENGAGEMENT OF TRIP PIN AND FINGER AT START OF TRIP CYCLE (WHEN ACTUATED BY KICK FOOT)
TRIP GEAR AT NO TEETH POSITION (MICRO SWITCH DETENTED)
TRACKING GEAR ROTATING
TOLERANCE THIS DIRECTION, TEETH MUST NOT RUB
FINGERS
KICK FOOT
MICRO SWITCH CLOSED WITH MIN FORCE IN DETENT
SWITCH ADJUSTMENT
TRIP PIN IN MAX BACK POSITION, TO BE HORIZONTAL OR IN DIRECTION SHOWN
Figure A
INDENTATION (DETENT)
TRIP GEAR ROTATING THRU TRIP CYCLE
HIGH POINT OF CAM
MICRO SWITCH OPEN WITHOUT JAMMING
Figure B

Figure 8. Micro Switch Adjustment

7. RESTRICTOR ARM REPLACEMENT

A. Reason

To allow the tone arm to be recaptured into the notch of the restrictor from any normal angles of record run out grooves.

B. Pre-Condition

None

C. Disassembly

None

D. Method of Adjustment (Use tool No. 4) Refer to figure 3

Loosen the restrictor nut. Position the restrictor arm so that the top surface is horizontal to slightly below. Make sure the restrictor rod is tight, then tighten the nut while holding the restrictor arm.

8. SPEED SHIFT AND MOTOR ALIGNMENT

A. Reason

1. To ensure that the belt shifts (climbs) completely to and from 33⅓ and 45 RPM spherical drive surfaces.
2. To align the motor and pulley axis so that it is parallel with the platter belt surface and to minimize speed drift.

B. Pre-Condition

None

NOTE: A special 7" diameter test platter is required for access to the various adjustments while operating.

C. Required Disassembly

Stages 1 and 2.

D. Method of Adjustment

1. If belt does not shift completely: (adjust and try in stages)
   a) Clean any belt residue from pulley with alcohol or solvent.
   b) Reverse belt (inside out) and try. Generally the belt will shift better with the shiny side inward, though either side is acceptable.
   c) Adjust pulley height by loosening set screw (Use tool no. 6). Position higher for better shifting downward to 45 RPM or lower for better shifting upward to 33-1/3 RPM. Check that the belt is not rubbing on pulley flange or the shifter *after* the belt is correctly located on either spherical diameter of pulley.

      CAUTION: Do not raise the pulley more than 1/16" higher than the highest portion of the shifter as the pulley can rub on the underside of the full size platter.

   d) Adjust motor angle, see Paragraph 2 (Use tool no. 7): This adjustment while basically a speed drift correction, can affect shifting. Adjust per below and then fine adjust set screws in *small* increments: L.H. screw in (clockwise) better downward shifting. R.H. screw in (clockwise) better upward shifting. Check speed drift with strobe.

      CAUTION: Do not over tighten these screws as the motor plate can become warped and cause hum or rumble.

   e) Adjust shifter and plate assembly by loosening three screws. (Use tool no. 1). Move the assembly side to side for optimum belt climbing up and down, generally sliding the assembly up and to the right (N.E.) will yield the best results.
   f) Adjust shifter by loosening detent spring screws (Use tool no. 2). Position the spring so that detenting action is positive and optimum belt climbing is achieved. In most cases the shifter should overhang the shifter plate by 1/16", when in the 33-1/3 position, for best results.
2. Motor Angle (Use tool no. 7):

   With 7" test platter and belt installed (shiny side in), run at 33-1/3 speed and observe belt position on motor pulley. Start with both adjustment set screws not touching the motor housing. Turn whichever screw is required to cause the belt to ride exactly in the center of the spherical diameter on the pulley. Turn the second screw to just contact the motor housing and not add any tension to the motor.

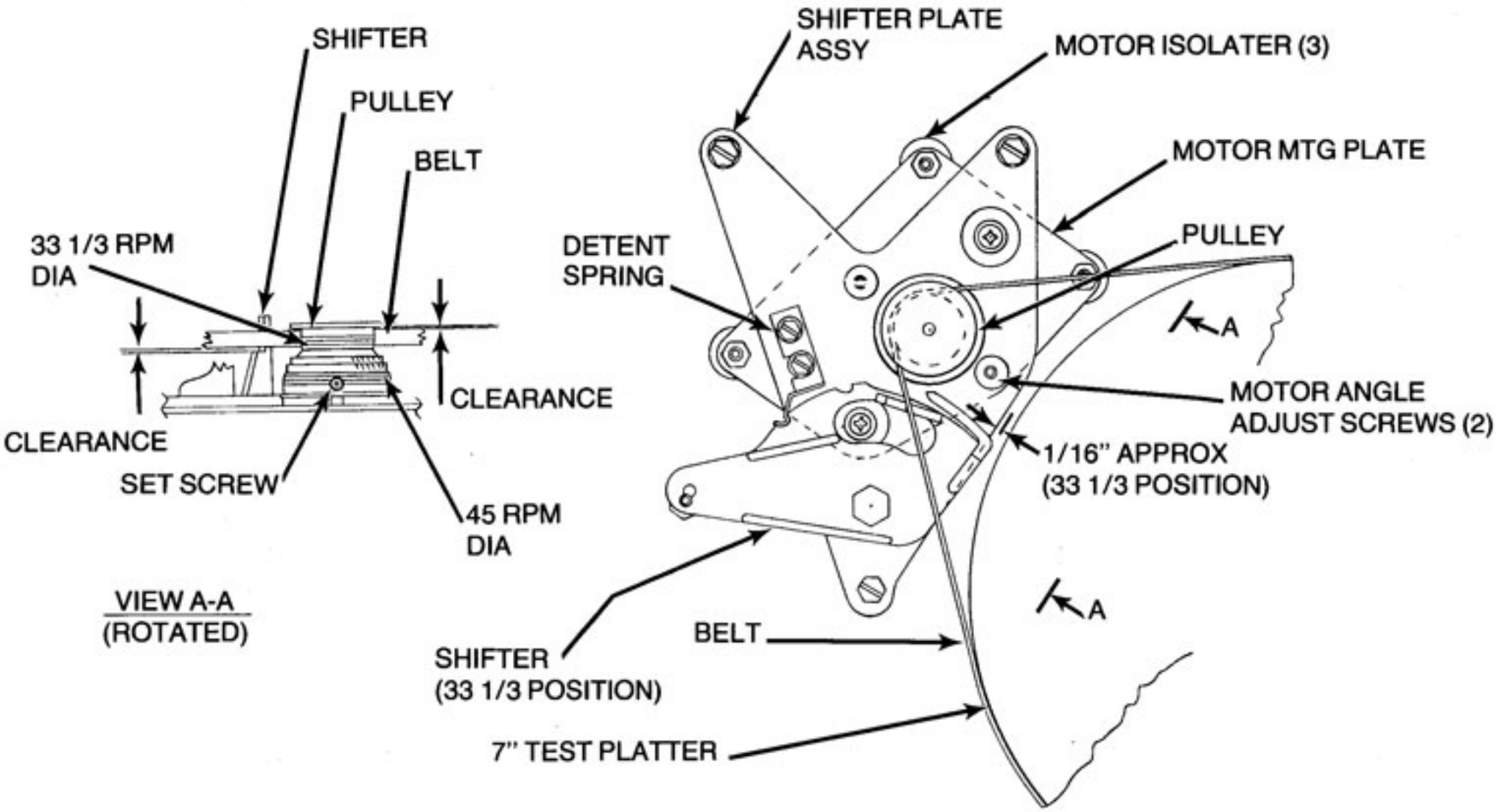


Figure 9. Speed Shift and Motor Alignment

9. CONVERSION OF ST5 MULTIVOLTAGE UNITS

A. Reason

To convert unit to required voltage and frequency. (Refer to Figure 3).

B. Pre-Condition

Line cord removed from socket.

C. Required Disassembly

Stages 1 and 2

D. Method

1. Locate multivoltage switch (Figure 3) and move lever to desired voltage.
2. Replace pulley with RV (smaller) domestic type (if 60 HZ operation).
3. Replace belt with smaller domestic type, if smaller pulley is used.
4. Replace the line cord, or select adapter for appropriate wall outlet.

10. CABLE CAPACITANCE MATCHING

A. Reason

To match ST5 cable capacitance as closely as possible to cartridge manufacturer recommendation, if desired.

B. Pre-Condition

Determine cable capacitance recommended by manufacturer.

C. Required Disassembly

Stages 1 and 2

D. Method of Adjustment

Locate Terminal Strip TB1 on Figure 3. The signal cable pairs are terminals 1 and 2, and 4 and 5. The existing cable capacitance for each pair is approximately 110 picofarads. Add the difference in capacitance (manufacturers recommendation less 110 pf) across each pair of terminals (1-2 and 4-5).

11. CARRIAGE ASSEMBLY REMOVAL

A. Reason

To facilitate repair and/or replacement of component parts of the carriage assembly.

B. Pre-Condition

None

C. Required Disassembly

Stage 1 through 4

D. Method of Removal (Refer to Figure 10)

Remove counterweight and tone arm. Locate terminal strip TB1 on Fig. 3. Unsolder five tone arm signal leads (red, green, yellow, white, black), referring to Figs. 3, 10, 12, remove tracking shaft pulley (51) by loosening two set screws (203), retain washer (211), remove L.H. support assembly (50) by removing two screws (183) and washers (247), retain washers (75) from slide shaft. Remove tracking shaft support assembly (49) by removing two screws (182) and washer (247). NOTE: Removing entire trip mechanism assembly will be helpful at this point; loosen two screws (182) and slide out. Remove slide rod assembly (71) partially from R.H. support and carefully slide carriage assembly off from tracking shaft (72) and slide rod (71).

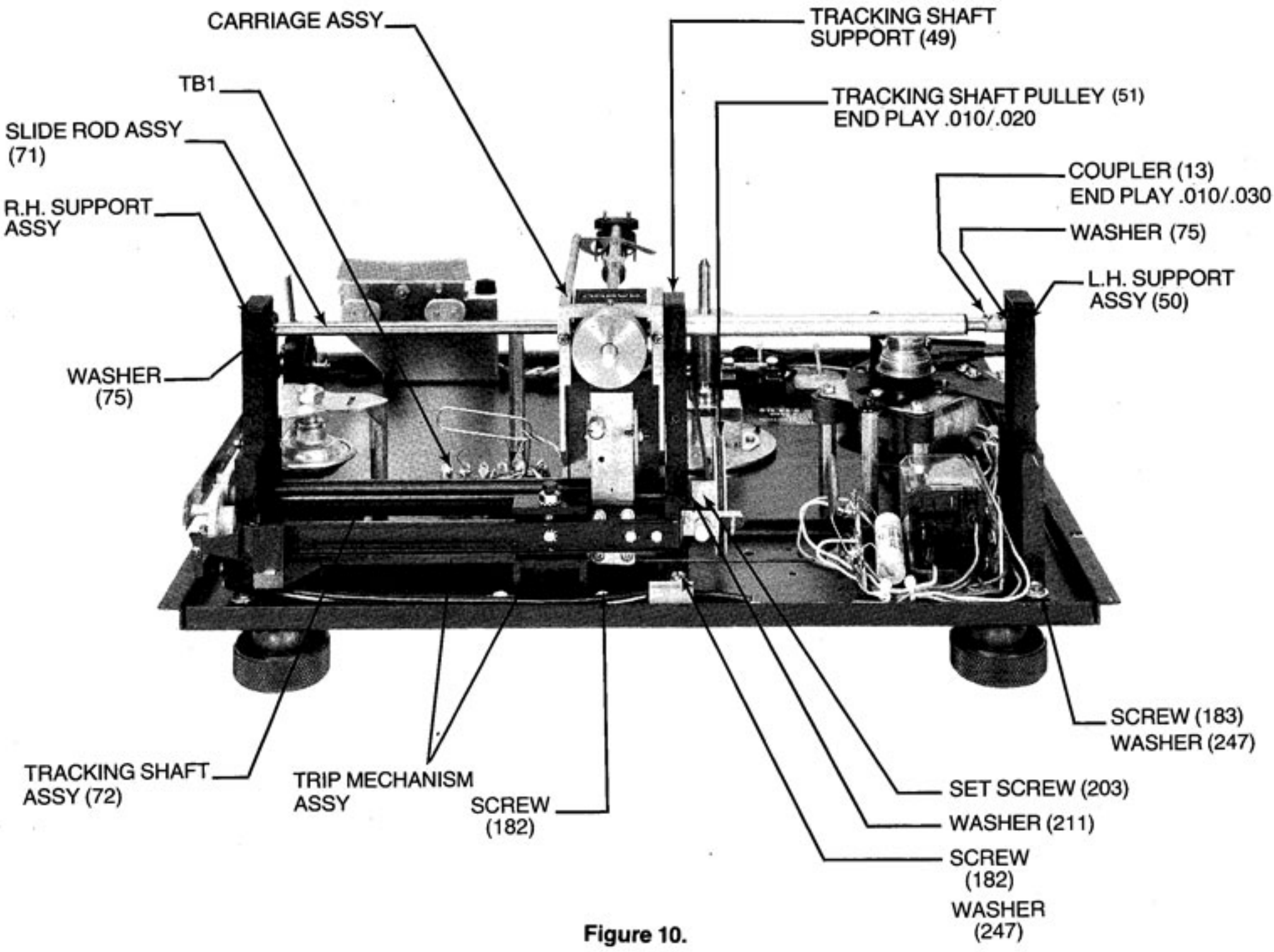


Figure 10.

12. TRACKING SCREW ADJUSTMENT

A. Reason

To correct any leading or lagging of the tone arm with respect to the carriage assembly.

B. Pre-Condition

The following adjustments must have been completed; lift pin and stop bar screw, the tone arm must be balanced and properly weighted.

C. Required Disassembly

None

D. Method of Adjustment (Refer to figure 11)

Set the tone arm down on a commerical record turning at 33-1/3 RPM. Allow the arm to travel across approximately 1" of the record. Observe if the arm is leading or lagging the carriage by reference to the restrictor arm. Also cue the tone arm up and observe if the arm ascends straight or on an angle (from music grooves). If the arm is leading, the screw must be turned clockwise. If the arm is lagging, the screw must be turned counterclockwise. After each adjustment, the arm must be observed for the 1" travel as previously described. When the arm is tracking properly, it should be checked across an entire 33-1/3 12" record to determine if any accumulated lead or lag occurs. Correct the adjustment if necessary.

The criticality of this adjustment is that the tone arm be aligned within ±1/2° approximately at the stylus tip. This is approximately 1/16" (.062), 1.5mm displacement from the stylus to the rollamite pivot center.

NOTE:

1. Turn the screw in small increments approximately 1/8 of a turn at a time.
2. Turning the screw clockwise accelerates the carriage.
3. Turning the screw counterclockwise decelerates the carriage.

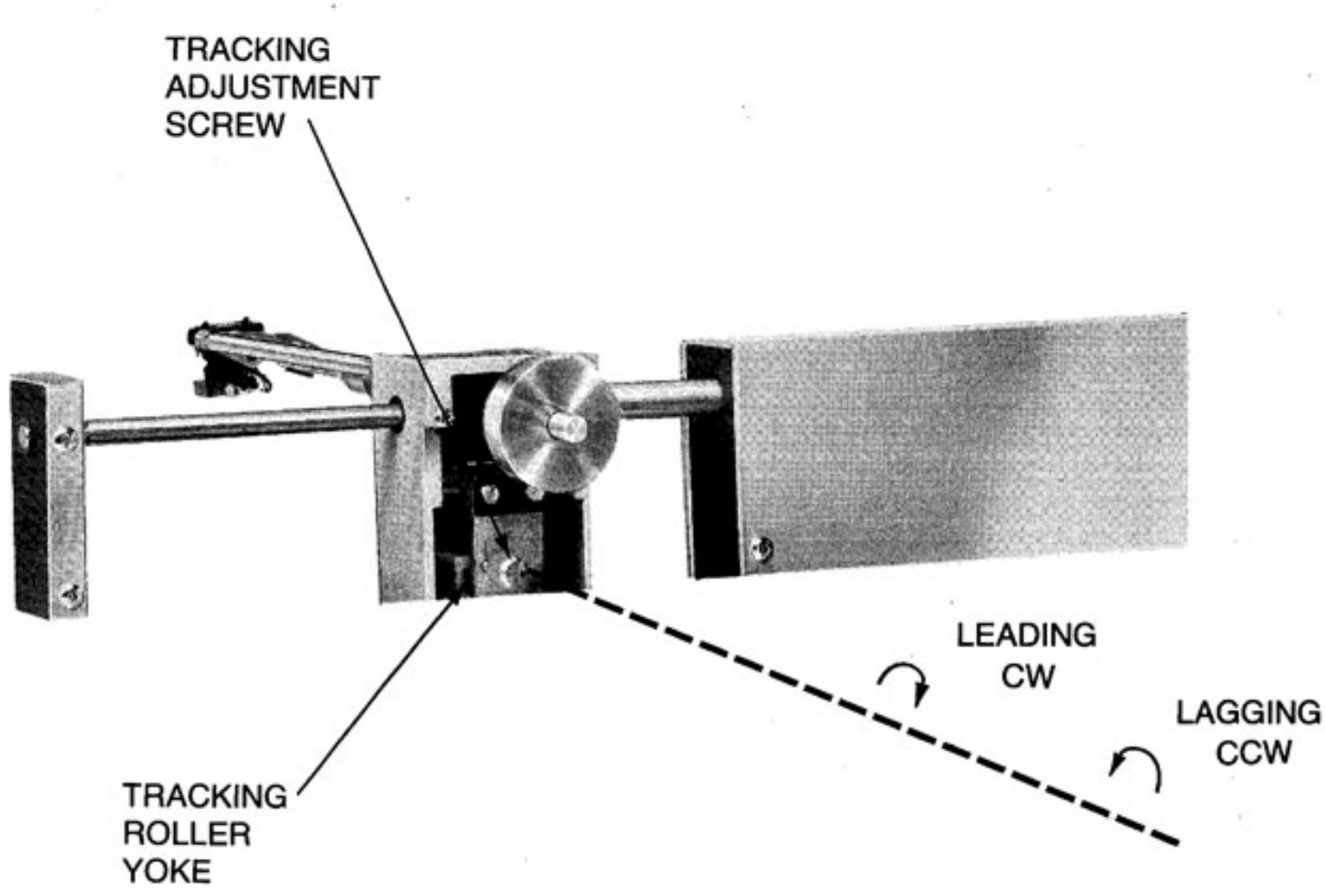


Figure 11.

OVERALL PARTS LIST ST-5
(Referenced to Figure 12)

Ref. No.	Part Number	Description
1	60132181A	Base Plate
2	61635531A	Edging
3	60130151A	Side Wall
4	60132180B	Top Plate, Front
5	60130190A	Top Plate, Rear
6	62535501B	Cover, L.H.
7	60130148A	Cover, R.H.
8	60132170A	Bracket On-Off Control
9	60130301A	Locknut Plate
10	01935835A	Cam Brkt & Shaft Assy
11	60130183A	Linkage, Cue Lever
12	64535837A	Trip Plate
13	60429276A	Coupler Shaft
14	60132087A	Plate Mtg, Carriage Assy
15	60130177A	Lift Plate
16	01930007A	Hub & Post Assy
17	01930006A	Spindle & Bearing Assy
18	60130294A	Retainer, Bearing
19	60130283A	Bracket, Dampening
20	60133079A	Plate, Motor Mtg.
21	60135533A	Plate, Shifter Mtg.
22	01936045A	Slide Support Assy, R.H.
23	60132514A	Stop Bracket, Trip Mechanism
24	60132517A	Mounting Bracket, Relay
25	62635319C	Stop Bar, Cue Lift
26	62635440C	Horizontal Carriage
27	60131592A	Pivot Bracket
28	01930021A	Roller Base Riveting Assy
29	60130156A	Receptacle, Connector
30	64535342A	Restrictor, Tone Arm
31	64500801A	Cover, Cartridge
32	01930018A	Trip Gear Staking Assy
33	57530106A	Cable Assy, Tone Arm
34	57530217A	Cable Assy, Roller
35	60335802A	Actuator Rod, Trip
36	62930202A	Platter
37	62930167A	Adaptor, 1.50 I.D. (38MM)
38	60400501A	Tracking Roller
39	61130110A	Roller, Tone Arm
40	61630239A	Dust Cover
41	61632233A	Grommet, Cue Lever
42	61636148A	Grommet, Speed Shifter
43	62830179A	Cam, Cueing
44	61632145A	Actuator, On-Off
45	61632179A	Spacer
46	62031486A	Isolator
47	63500101A	Adapter, Foot
48	60835828A	Gear, Tracking Shaft
49	01935780A	Support, Tracking Shaft, Assy
50	01935534A	Support, L.H., Assy
51	60830145A	Pulley, Tracking Shaft
52	61630194A	Bracket, Trip Pivot
53	61135376A	Carriage Guide
54	61630161A	Cover, Roller
55	61630101A	Mtg Plate, Cartridge
56	61631718A	Clamp, Cover
57	61630109A	Sleeve, Gram Weight
58	86535817A	Spacer, Rod
59	61430743A	Grommet, Eccentric
60	61630286A	Holder, Trip Actuator
61	61430746A	Pad, Foam
62	61635333A	Shim, Hinge
63	61630134A	Bracket, Tracking Roller
64	61130130A	Slide Bushing
65	61432276A	Pad, Rubber
66	61636147A	Belt Shifter
67	60431594A	Insert, Lift Pin
68	60430181A	Shaft, Linkage, Cue Cam
69	60430144A	Guide Rod
70	60430211A	Trip Pin
71	01935782A	Slide Rod Assy
72	01935781A	Tracking Shaft Assy
73	60335081A	Rod, Release
74	60335530A	Spring, Comp
75	85035014A	Flat Washer
*76	61435011A	Drive Belt, Slide Shaft
77	60431593A	Bearing Rod
78	60433304A	Lift Pin, Threaded
79	60430200A	Rod, Restrictor
80	60430272A	Rod, Counterweight
81	60432178A	Spacer, Bracket Adjust
82	60432175A	Pivot Stud
83	60430192A	Pivot
84	60431728A	Adjusting Scr, Stop Bar
85	63230178A	Lever, Cueing Cam
86	63231799A	Rod, Shifter
87	61730102A	Tone Arm Tube
88	61730276A	Gram Weight
89	84030758A	Locknut, Tone Arm
90	84031027A	Nut, Restrictor
91	60835528A	Drive Pulley (Domestic) 60 HZ
92	60835529A	Drive Pulley (Export) 50 HZ
93	61433883A	Turntable Mat
94	60630121A	Retainer, Grommet
95	60635532A	Spring, Detent
96	61930271A	Counterweight
97	61730129A	Slide Tube
98	61635305A	Roller Cue Guide
99	80619422A	Nut, Hex Keps 6-32
100	60332007A	Wire Guide, Audio
101	61830745A	Inner Covering
102	62021307A	Felt Pad
*103	61433164A	Belt, Turntable (Domestic)
*104	61431730A	Belt, Tracking
105	79032220A	Adjusting Screw, Pivot
106	61632239A	Lens
107	61430303A	'O' Ring
108	60630126A	Spring, Band
109	60630279A	Spring, Comp, Screw Locking
110	60631578A	Spring, Extension
111	60630299A	Spring, Compression
112	61600401A	Mounting Foot

OVERALL PARTS LIST ST-5 (continued)

Ref. No.	Part No.	Description
113	60630137A	Spring, Tracking Roller
114	61434512A	Grip Sleeve
115	87230118A	Standoff, Top Plate
116	67032787A	Retaining Ring
117	87232275A	Standoff, Threaded
*118	25031791A	Micro Switch (S1, S2, S3)
119	01732245A	Motor (M1)
*120	24532274A	Slide Switch (Export) (S4)
*121	13032263A	Relay (K1)
122	65430519A	Fuseholder
*123	45031348A	Fuse .5A Slo-Blo (F1)
124	53031873A	Phono Cable (Audio)
125	53029083A	Line Cord
126	53030949A	Line Cord (Export)
127	65033587A	Terminal Strip (TB3)
128	65231715A	Terminal Strip (TB1)
129	47632269A	Neon Lamp (DS1)
130	61931581A	Dash Pot
*131	36916525A	Resistor 6.5kΩ (R1)
*132	36915125A	Resistor 5.1kΩ (R2)
*133	30418307A	Capacitor .01UF 150VAC (C1,C5,C4)
*134	30532486A	Capacitor .047UF 1000VAC (C2)
*135	30532534A	Capacitor .33UF 400VAC (C3)(Export)
*136	30532273A	Capacitor .25UF 400VAC (C3)
137	67031885A	Clamp
138	65611705A	Ground Lug
139	61131575A	Bearing
140	65730737A	Ground Lug, Tone Arm
141	86530233A	Spacer Rod
142	67035334A	Free Stop Hinge Assy
143	67030830A	Lock Plate (Hinge)
144	60433119A	Adj Screw, Tracking
145	84030199A	Nut, Jam, Counterweight
146	84030117A	Nut, Jam, Receptacle
147	61431884A	Grommet, Phono Cable
148	60432397A	Grommet, Pilot Light
149	61430856A	Grommet, Strain Relief
150	61430510A	Grommet
151	67030808A	Retaining Ring
152	67030828A	Retaining Ring
153	67030815A	Retaining Ring
154	67032260A	Retaining Ring
155	67030801A	Retaining Ring
156	67030812A	Retaining Ring
157	67036139A	Retaining Ring
158	67030818A	Retaining Ring
159	67032443A	Retaining Ring
160	67030815A	Retaining Ring
161	85431586A	Curved Washer
162	70930459A	Screw, 4-40×3/8 M.S.
163	85432254A	Curved Washer
164	60132868A	Nut Plate
165	85431410A	Curved Washer
166	77830776A	Screw M4×0.7×.80M M.S.
167	70230712A	Screw 2-56×3/4 M.S.
168	79432247A	Screw 4-40×7/16 Type "23"
169	77830910A	Screw 4-40×3/16 M.S.
170	71935841A	Screw 4-40×3/16 H.H.
171	79432247A	Screw 4-40×7/16 Type "23"
172	78931210A	Screw 2-56×1/8 M.S.
173	70230712A	Screw 2-56×3/4 M.S.
174	87930849A	Screw, Drive #00×1/8 Type U
175	71930931A	Screw 6-32×3/16 M.S.
176	78732222A	Screw 4-40×1/4 Type "23"
177	70818675A	Screw 4-40×1-1/8 M.S.
178	78730929A	Screw 4-40×3/16 Type "23"
179	77831589A	Screw 4-40×3/8 M.S.
180	80619403A	Nut, Hex, Keps 4-40
181	72532246A	Screw #4×1/4 Type "B"
182	79632767A	Screw 6-32×3/8 Type "23"
183	79632768A	Screw 6-32×1/2 Type "23"
184	77630917A	Screw 6-32×5/16 Type "23"
185	77830893A	Screw 6-32×1/4 M.S.
186	77832277A	Screw 4-40×1/4 M.S.
187	79031798A	Shoulder Screw
188	77832426A	Screw 6-32×1/2 M.S.
189	75830777A	Screw 4-40×3/8 Type "F"
190	70219614A	Screw 4-40×1/4
191	77830891A	Screw 4-40×5/16 M.S.
192	70230709A	Screw 4-40×7/16 M.S.
193	71833143A	Screw 6-32×5/16 M.S.
194	77832262A	Screw 8-32×7/16 M.S.
195	70630773A	Screw 4-40×5/16 M.S.
196	70630890A	Screw 4-40×3/16 M.S.
197	79734445A	Screw 6-32×5/16 Taptite
198	79535842A	Screw 2×3/16 Type "B"
199	85036143A	Washer Flat #2
200	81219328A	Nut, Hex, Self-locking 6-32
201	85019824A	Washer, Flat
202	72132185A	Screw, Set 4-40×1/4
203	72130713A	Screw, Set 4-40×1/8
204	72131738A	Screw, Set 6-32×5/16 Oval Pt
205	85035226A	Washer, Flat
206	85030847A	Washer, Flat #2 Med.
207	85030244A	Washer, Flat, Linkage
208	85030884A	Washer, Flat #3 Med.
209	85030845A	Washer, Flat #4
210	85030850A	Washer, Flat #6
211	85033946A	Washer, Flat
212	85032082A	Thrust Washer
213	85030236A	Washer, Flat
214	85019248A	Washer, Flat #8
215	85130848A	Lockwasher #2 Split
216	85219238A	Washer Int. Lock 5/16
217	85231487A	Lockwasher Int. Receptacle
*218	61434037A	Belt, Turntable (Export)
219	85130863A	Lockwasher #6 Split
220	80619508A	Nut, Hex, Keps 6-32
221	85333582A	L'Washer Ext Tooth #6
222	80619582A	Nut, Hex, Keps 8-32
223	80131582A	Nut, Hex, Jam 5/16-24
224	80130853A	Nut, Hex 6-32

OVERALL PARTS LIST ST-5 (continued)

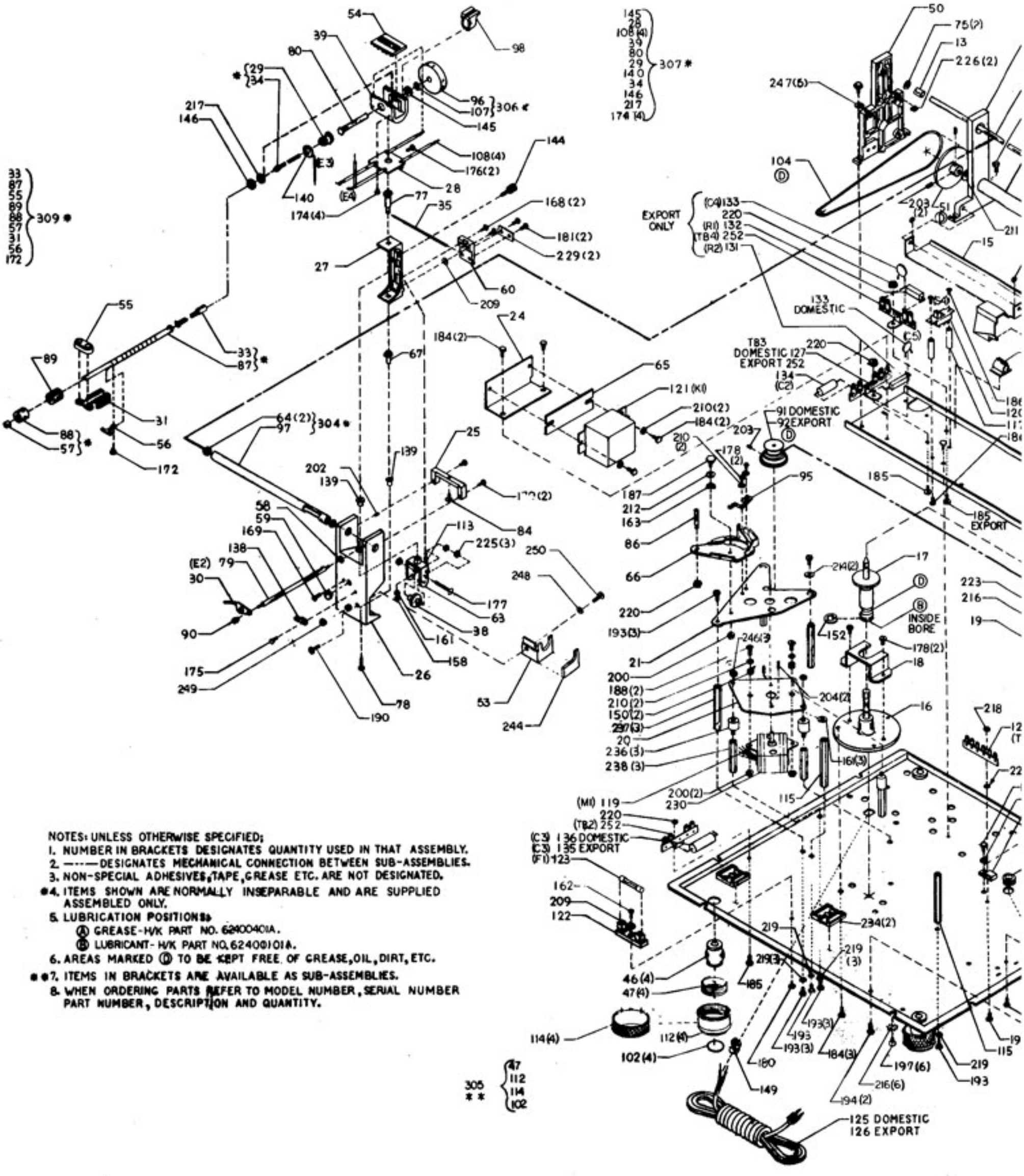
Ref. No.	Part No.	Description
225	80130860A	Nut, Hex 4-40
226	84034552A	Speed Nut 4-36
227	85319818A	Lockwasher, Ext Tooth #4
228	61432696A	Screw Tip Cover
229	60132873A	Plate Retaining-Actuator
230	60132701A	Shield, Motor
231	61632884A	Level, Circular
232	67029865A	Clamp
233	60336149A	Trip Spring
234	67029700A	Harness Mount
235	80132786A	Nut Hex 8-32
236	62033059A	Vibration Mount
237	87233082A	Standoff, Shifter Plate
238	87233081A	Standoff, Motor Plate
239	60335838A	Extension
240	64835801A	Adjusting Screw, Trip
241	60335810A	Holder, Trip Spring
242	64535803A	Bracket, Holder
243	62400101A	Lubricant
244	61435337A	Damper, Guide
245	64536141A	Kick Foot
246	80119579A	Nut Hex #8
247	85019242A	Washer, Flat #8
248	85033757A	Washer, Flat #4
249	80619403A	Nut, Hex Keps 4-40
250	70218670A	Screw 4-40×1/2
251	85033947A	Washer, Flat
252	65030973A	Terminal Strip (TB2, 4)
253	85033761A	Washer, Flat
300	01930025B	Side Wall Assy
301	01935831A	Top Plate Assy (Front)
302	01935836A	Top Plate Assy (Rear)
*303	01832550A	Pilot Light Assy (DSI)
304	01930029A	Slide Tube Assy
305	01934418A	Mtg Foot Assy
306	01930036A	Counterweight Assy
307	01930023B	Roller Assy
308	01936044A	Dust Cover Assy
309	01635847A	Tone Arm Assy (Less Kit)
310	67034291A	Retainer, Level
311	61834312A	Shield, Level
312	01934309A	L.H. Cover Assy
313	01935840A	Trip Spring Assy

*Recommended Spares

REPLACEMENT PARTS LIST ORDER NOTE:

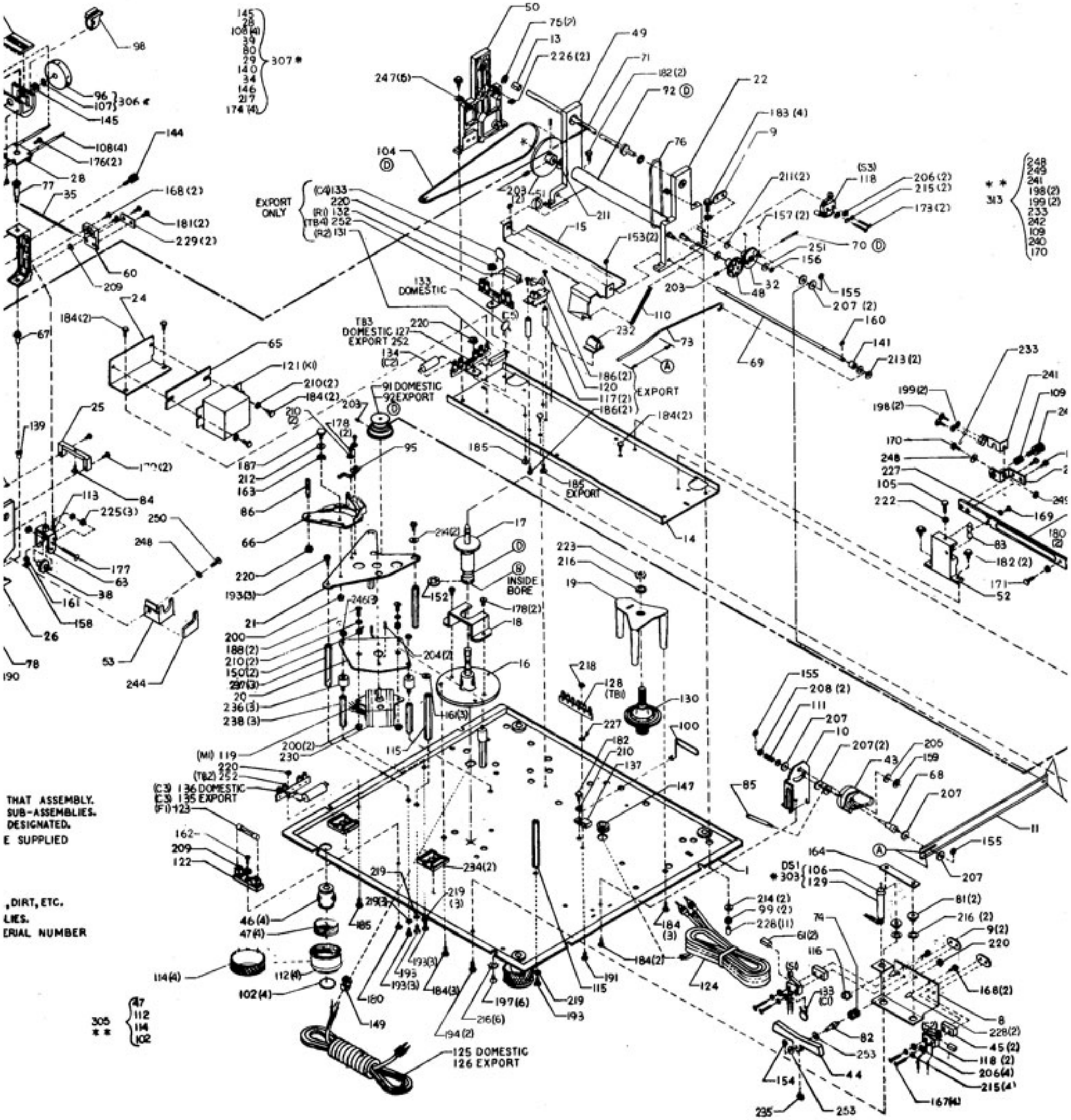
To speed handling of your order be sure to include both the model and serial numbers that appear on the bottom of the base, in addition to the quantity, part number and part discription of the items ordered. Orders from independent dealers, independent servicemen, and retail customers will be shipped on a cash-in-advance basis. Harman-Kardon reserves the right to substitute equivalent parts for those originally installed in this unit. All parts should be ordered from Harman-Kardon, 55 Ames Court, Plainview, L.I., N.Y. 11803, Att: Parts Department.

Figure 12. ST-5 Exploded View



NOTES: UNLESS OTHERWISE SPECIFIED;

1. NUMBER IN BRACKETS DESIGNATES QUANTITY USED IN THAT ASSEMBLY.
2. ——— DESIGNATES MECHANICAL CONNECTION BETWEEN SUB-ASSEMBLIES.
3. NON-SPECIAL ADHESIVES, TAPE, GREASE ETC. ARE NOT DESIGNATED.
- *4. ITEMS SHOWN ARE NORMALLY INSEPARABLE AND ARE SUPPLIED ASSEMBLED ONLY.
5. LUBRICATION POSITIONS:
   - Ⓐ GREASE-H/K PART NO. 624004014.
   - Ⓑ LUBRICANT- H/K PART NO. 624001014.
6. AREAS MARKED Ⓓ TO BE KEPT FREE OF GREASE, OIL, DIRT, ETC.
- * *7. ITEMS IN BRACKETS ARE AVAILABLE AS SUB-ASSEMBLIES.
8. WHEN ORDERING PARTS REFER TO MODEL NUMBER, SERIAL NUMBER PART NUMBER, DESCRIPTION AND QUANTITY.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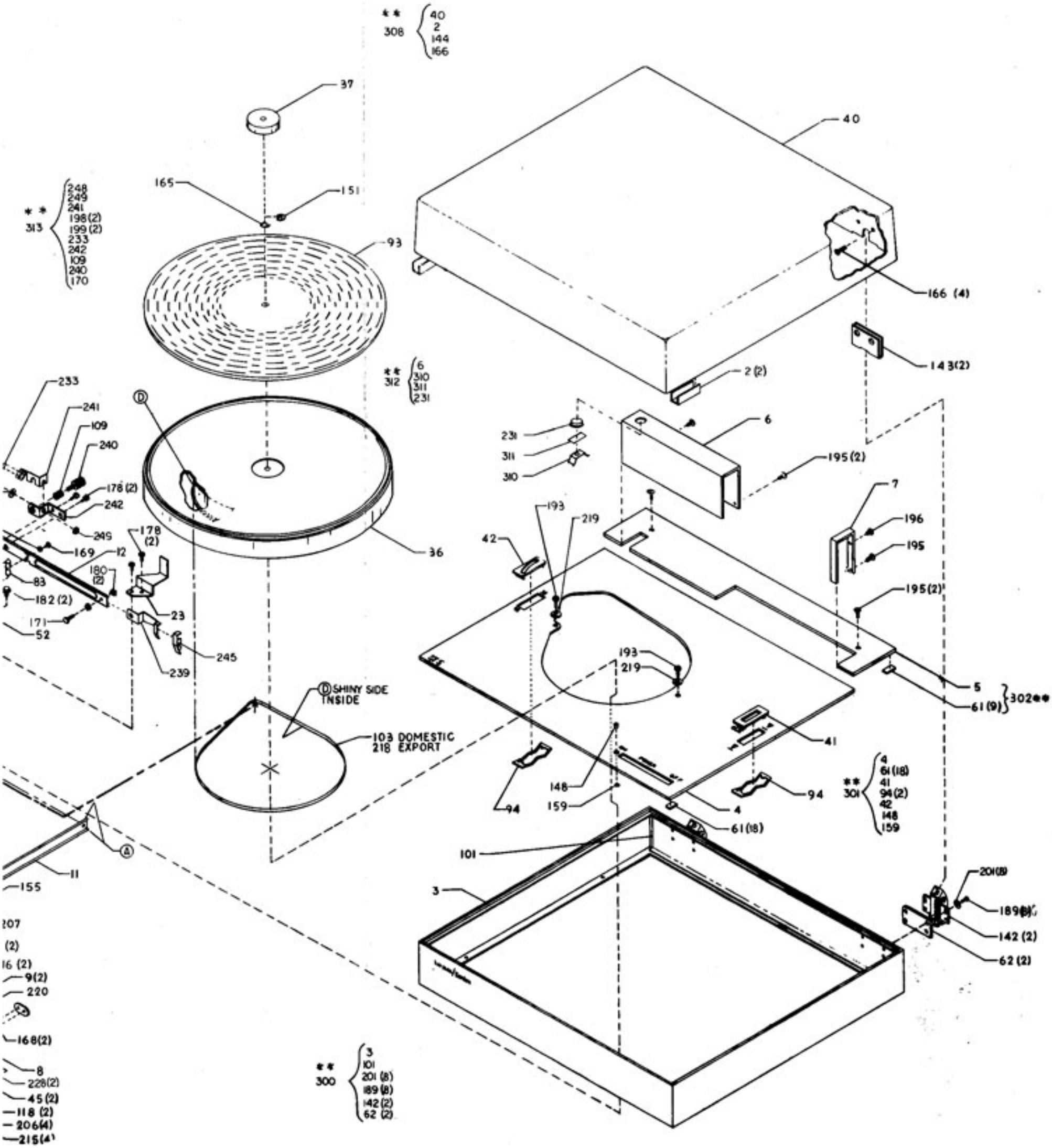
52
248
249
241
198(2)
199(2)
233
242
109
240
170
303
THAT ASSEMBLY.
SUB-ASSEMBLIES.
DESIGNATED.
E SUPPLIED
, DIRT, ETC.
LIES.
ERIAL NUMBER


** 308 40 2 144 166
37
165
151
** 313 248 249 241 198(2) 199(2) 233 242 109 240 170
93
40
166 (4)
143(2)
2 (2)
** 312 6 310 311 231
233
241
109
240
178 (2)
242
245
169
12
178 (2)
180 (2)
83
182 (2)
171
52
23
239
245
36
231
311
310
6
195(2)
7
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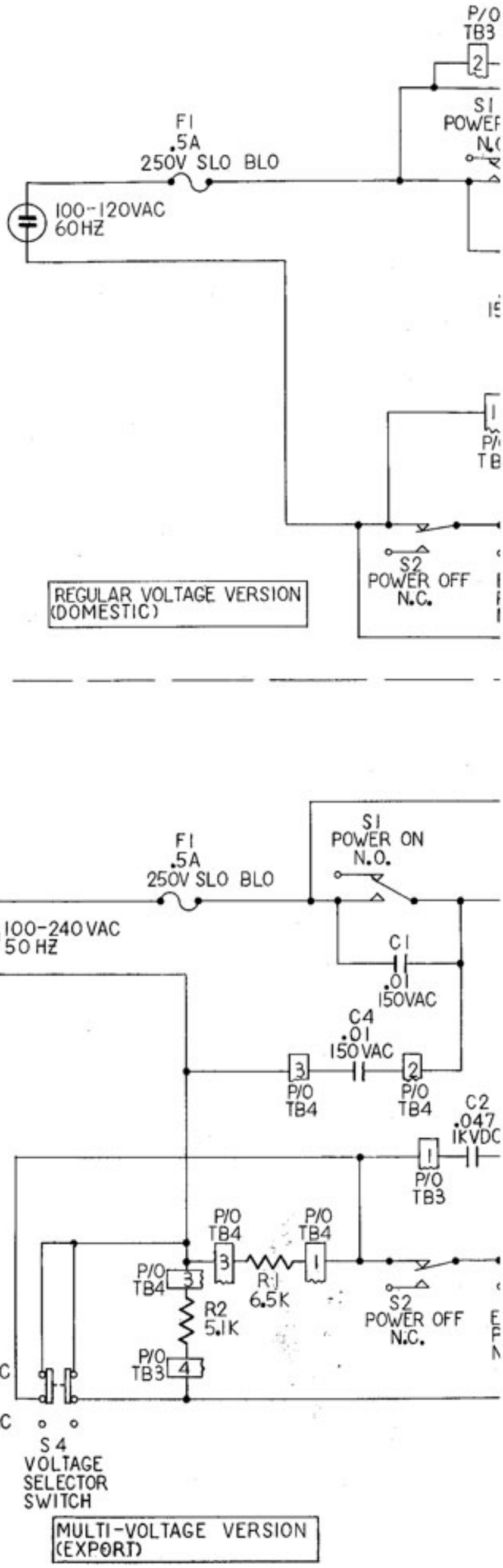
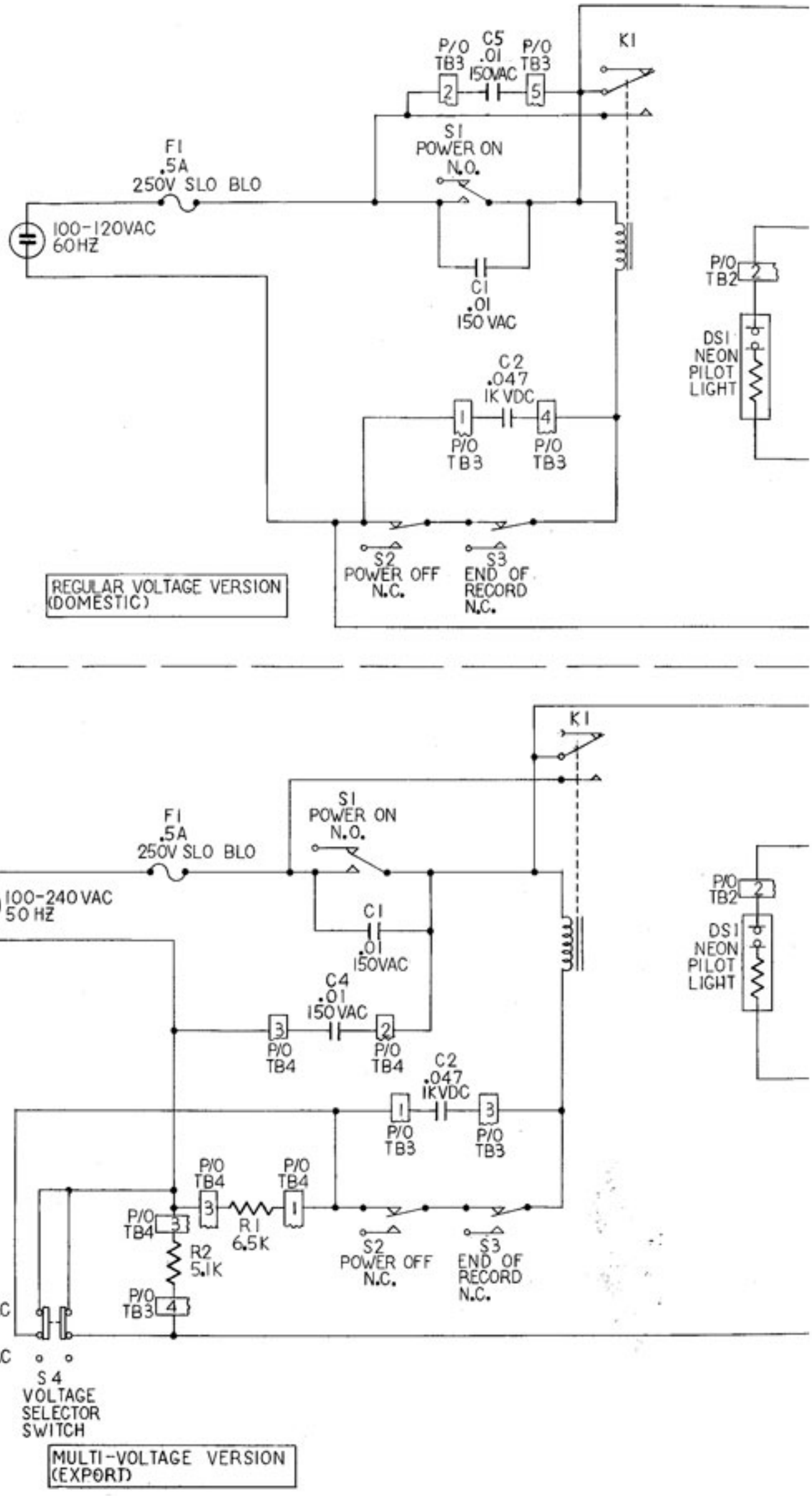
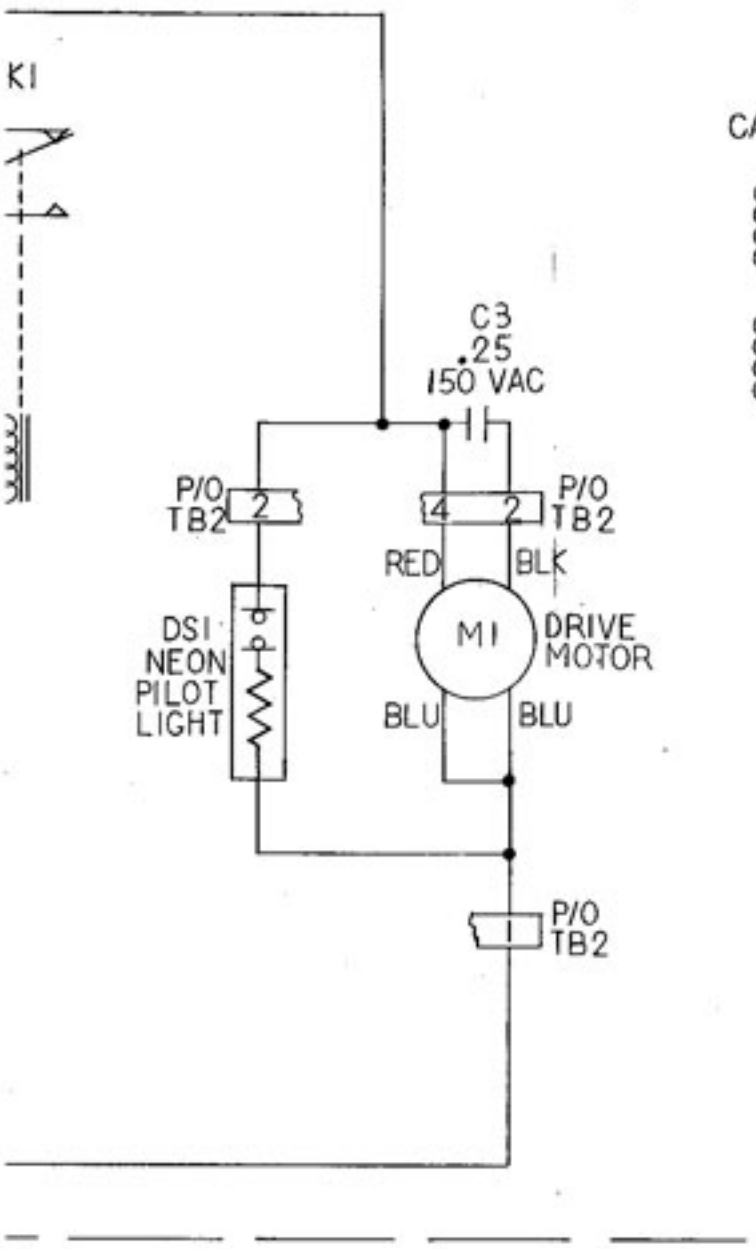
193
219
42
195(2)
193
219
5
61 (9) 302**
D SHINY SIDE INSIDE
103 DOMESTIC 218 EXPORT
41
94
148
159
4
61(18)
** 301 4 61(18) 41 94(2) 42 148 159
101
3
201(8)
189(8)
142 (2)
62 (2)
11
155
207
(2)
16 (2)
9(2)
220
168(2)
8
228(2)
45 (2)
118 (2)
206(4)
215(4)
** 300 3 101 201 (8) 189 (8) 142 (2) 62 (2)

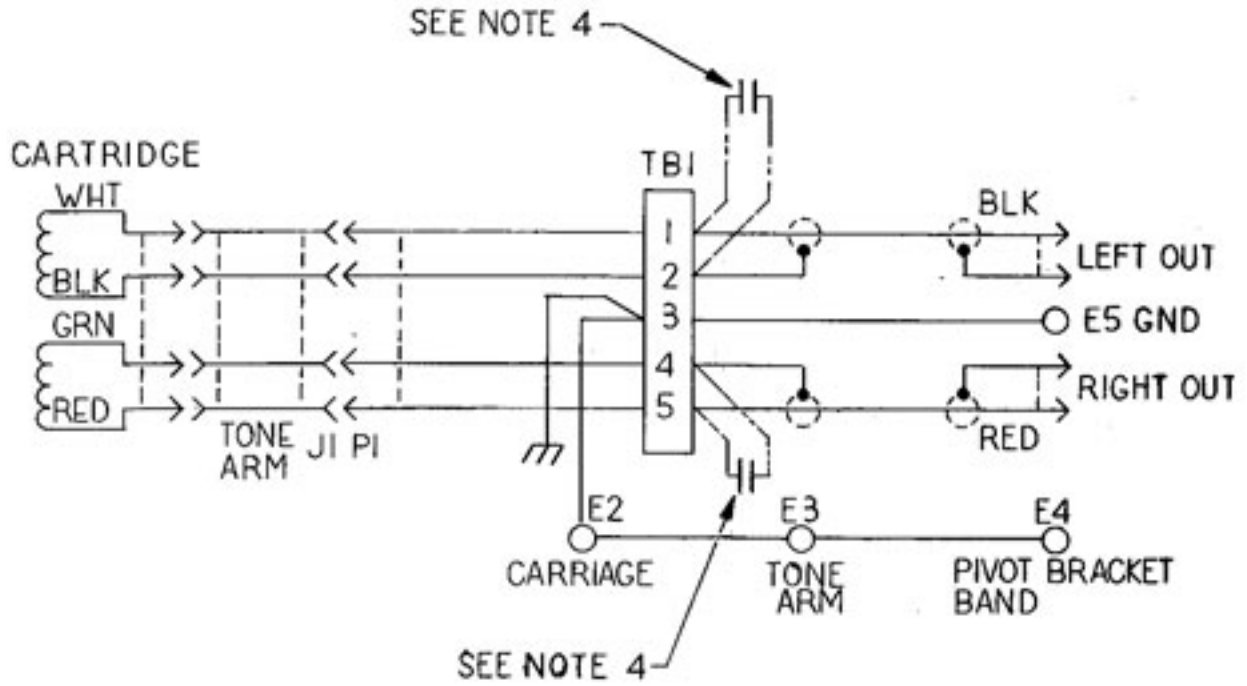
Figure 13. ST-5 System Schematic



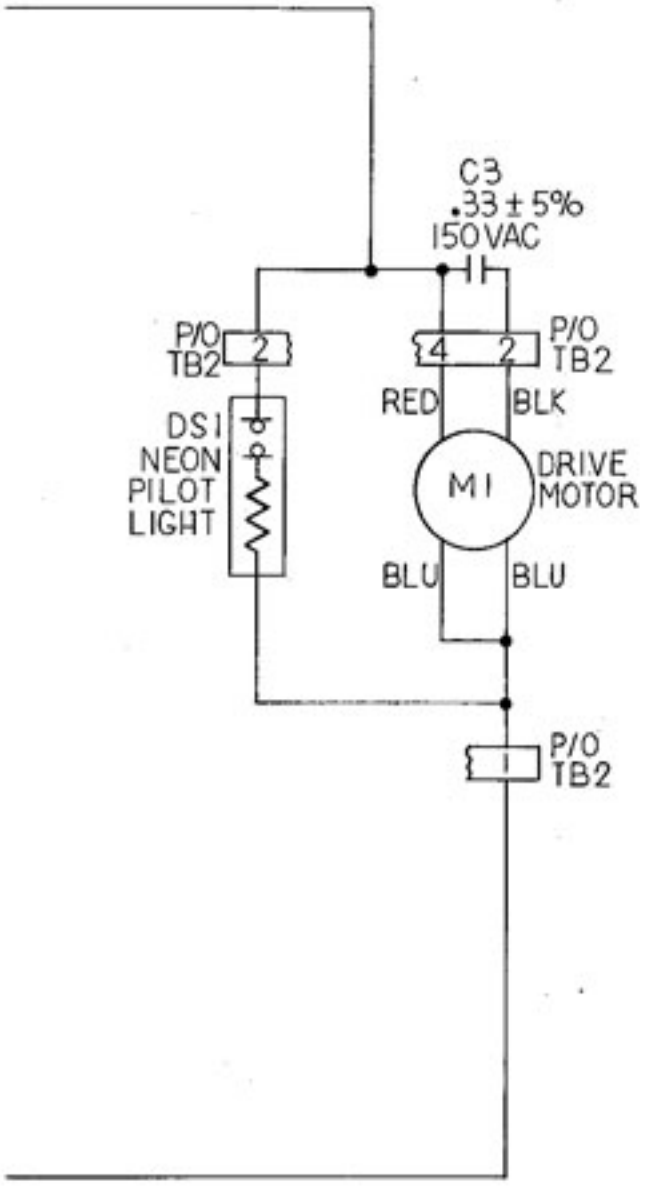
stem Schematic







NOTES: UNLESS OTHERWISE SPECIFIED;
1. ALL CAPACITORS VALUES IN MICROFARADS ± 10%.
2. ALL RESISTOR VALUES IN OHMS ± 5%, 10W.
3. S1, S2, S3 ARE MOMENTARY.
4. CABLE MATCHING CAPACITANCE. SEE ADJUSTMENT 10.



CHASSIS COMPONENTS		
HIGHEST REF DES USED		REF DES NOT USED
C5	R2	
F1	S4	
M1	K1	
DS1	TB4	
E5		E1